



Medicinal plants used by traditional healers from South-West Algeria: An ethnobotanical study

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ABSTRACT

Background/Aim: This study aimed to document and analyzes the local knowledge of medicinal plants' use by traditional healers in South-west Algeria. **Methods:** The ethnobotanical survey was conducted in two Saharian regions of South-west of Algeria: Adrar and Bechar. In total, 22 local traditional healers were interviewed using semi-structured questionnaire and open questions. Use value (UV), fidelity level (FL), and informant consensus factor (FIC) were used to analyze the obtained data. **Results:** Our results showed that 83 medicinal plants species belonging to 38 families are used by traditional healers from South-west of Algeria to treat several ailments. Lamiaceae, Asteraceae, Apiaceae, and Fabaceae were the most dominant families with 13, 8, 6, and 4 species, respectively. Leaves were the plant parts mostly used (36%), followed by seeds (18%), aerial parts (17%) and roots (12%). Furthermore, a decoction was the major mode of preparation (49%), and oral administration was the most preferred (80%). *Thymus vulgaris* L. (UV = 1.045), *Zingiber officinale* Roscoe (UV = 0.863), *Trigonella foenum-graecum* L. (UV=0.590), *Rosmarinus officinalis* L. (UV = 0.545), and *Ruta chalepensis* L. (UV = 0.5) were the most frequently species used by local healers. A great informant consensus has been demonstrated for kidney (0.727), cancer (0.687), digestive (0.603), and respiratory diseases. **Conclusion:** This study revealed rich ethnomedicinal knowledge in South-west Algeria. The reported species with high UV, FL, and FIC could be of great interest for further pharmacological studies.

KEY WORDS: Algeria, ethnobotanical, medicinal plants, phytotherapy, traditional healers, use-value

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Received: May 20, 2016

Accepted: July 20, 2016

Published: Aug 22, 2016

INTRODUCTION

According to the WHO statistics, about 80% of African populations use traditional medicine for their primary health care. In recent years, there has been a remarkable rise of medicinal plant's use, probably due to their local abundance, cultural significance and inexpensive procurement [1]. An urgent need to develop national pharmacopoeia, monographs of medicinal plants, and national standards and guidelines has been emphasized [2]. It has been reported that of 121 anticancer drugs used today, 90 are derived from plants. In addition, 60% of new drugs introduced between 1981 and 2002 are plants derived [3]. Although, the development of new active natural drugs requires integration of several sciences such as botany, chemistry and pharmacology, recording how a plant is used in folk medicine by an ethnic group is the major common strategy [4]. In addition, ethnobotanical studies play an important role for the conservation and valorization of biological resources [5].

Medicinal plants have been used in Algeria for centuries to treat different ailments. Although Algeria is one of the richest Arab countries with 3164 plant species [6], few ethnobotanical studies have been carried out in the country [7,8]. In South of Algeria, the Sahara, one of the world-largest deserts, local

populations still relay on traditional healers for their health care. Thus, the aim of this study was to document and analyze the local knowledge of medicinal plants' use by traditional healers in South-west Algeria.

MATERIALS AND METHODS

Study Area

Sahara, the world's largest non-polar desert covers 84% of the total Algerian area (2.381.741 km²). The ethnobotanical survey was conducted in two Saharian regions of South-west of Algeria: Adrar and Bechar, both located on the borders between Algeria and Morocco [Figure 1]. Adrar (27°52' N, 0°17' W) is the second-largest department of the country covering about 427,368 km² [9]. Bechar (31°37' N, 2°13' W) covering an area of 161,400 km² is the sixth-largest department in the country. Climate is hot and dry in summer and very cold in winter with 100 mm rainfall per year [10].

Data Collection

This study has been carried out between 2010 and 2014, in several times. We interviewed individually 22 traditional healers

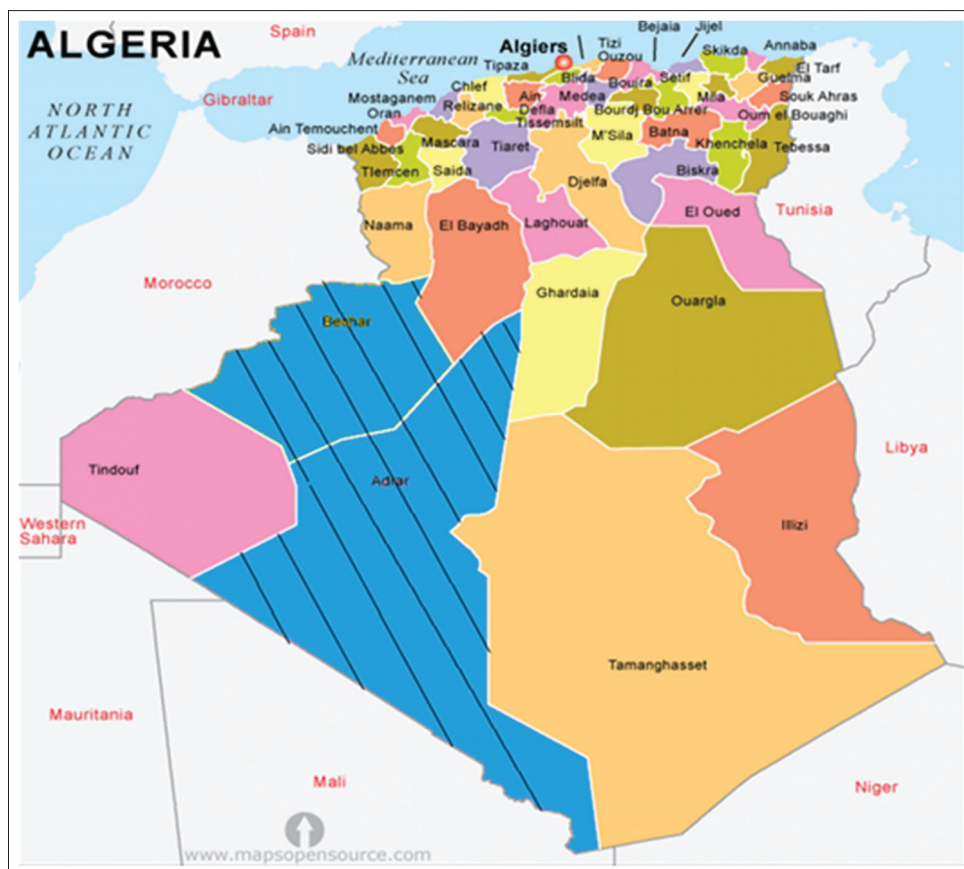


Figure 1: Location of the study area (Adrar and Bechar, South-West Algeria)

practicing in the study area, after obtaining their consent. Semi-structured questionnaire and open questions were used to record the use of medicinal plants (vernacular names, ailments treated, parts used, modes of preparation/administration, and ingredients). Local names were given in Arabic and/or in Amazigh or Tergui languages. Botanical identification and authentication were done by Dr. Kada Righi (Department of Agriculture, Faculty of Nature and Life sciences, Mascara University, Algeria). The voucher specimens were prepared and submitted to the LRSBG herbarium (Department of Biology, Faculty of Nature and Life Sciences, Mascara University, Algeria). All the informants were men and their age was 37 ± 11 years.

The ailments reported to be treated using the cited species were grouped into 12 categories [Table 1]. Each citation of a particular part of a particular plant was recorded as one use report. If one informant used a plant to treat more than one disease in the same category, it was considered as a single use-report [11].

Quantitative Analysis

Use-value (UV), fidelity level (FL), and informant consensus factor (FIC) were calculated using the following standard formulas [12]:

$$\text{Use-value: } UV = \Sigma U/n$$

U: Number of use reports cited by each informant for a given plant species,

n: Total number of informants interviewed for a given plant.

$$\text{Fidelity level (FL): } FL (\%) = (N_p/N) * 100$$

N_p : Number of use reports for a given species reported to be used for a particular ailment category,

N: Total number of use reports cited for any given species.

$$\text{Informant Consensus Factor: } FIC = (N_{ur} - N_t) / (N_{ur} - 1)$$

N_{ur} : Number of use citations in each category,

N_t : Number of species reported in each category.

RESULTS

Botanical Data, Used Parts, Mode of Preparation, Routes of Administration and Ailments Treated

In this study, 83 medicinal plants species belonging to 38 families [Figure 2] were reported to be used by traditional healers from South-west of Algeria to treat several ailments [Table 2]. In consistence with most of ethnobotanical studies around the world, leaves were the plant parts mostly used (36%) by local healers in South-west of Algeria. In addition, seeds (18%), aerial parts (17%), and roots (12%) were also the most used parts [Figure 3]. We found that a decoction was the major mode of preparation (49%). In addition, different medicinal plants are used as raw (32%), infused (16%), or macerated (3%) [Figure 4]. Oral, topical, inhalation, and nasal routes were the reported ways of administration in the study area. As shown in Figure 5, most herbal remedies in South-west Algeria were

Table 1: Ailments grouped by different ailment categories

Category	Ailments/disorders	Abbreviation
Kidneys diseases	Stone, infections	KD
Gastro-intestinal diseases	Hemorrhoids, stomach ulcer, stomach-ache, dysentery, colic, gases, constipation, colitis, parasites, hydatid cyst, liver problems, hepatitis, biliary problems, anemia, diarrhoea, toothache	GISD
Skin diseases	Skin diseases, fungal infections, burns	SD
Cancer	Tumors, cancers, metastases	Can
Endocrine system diseases	Diabetes, goitre, weight loss	ESD
Respiratory tract diseases	Cold, cough, asthma, bronchitis, flu, allergy	RTD
Skeleto-muscular system disorder	Rheumatism, arthritis, inflammation, body pain	SMSD
Cardiovascular system diseases	Cholesterol, high blood pressure, heart problems	CSD
General health	Blood purification, body pain, tonic, psychopathic disorders, systemic healing, systemic problems	GH
Hair care	Hair loss, hair growth	HC
Nervous system	Depression, anxiety, vertigo, migraine, dementia, depression	NS
Sexual-reproductive problems	Menstrual cramps, infertility, sexual impotence, gynecological problems	SRP

Table 2: List of medicinal plants used by traditional healers in South west-Algeria

Botanical name	Part used	Ailment category: N of use reports	Preparation method	Administration	UV
<i>Acacia gummifera</i> Willd. Mimosaceae	Roots	RTSD: 6 (cough, bronchitis)	Infusion	Oral	0.318
<i>Ajuga iva</i> (L.) Schreb. Lamiaceae	Aerial parts	CSD: 1 (hypertension) GISD: 2 (digestive disorders) ESD: 1 (diabetes)	Raw Decoction Decoction	Oral Oral Oral	0.136
<i>Ammoides pusilla</i> (Brot.) Breistr. Apiaceae	Fruit	CSD: 2 (hypertension) RTD: 1 (flu) NS: 1 (vertigo) GH: 1 (tonic)	Decoction Infusion Decoction	Oral	0.227
<i>Anacyclus pyrethrum</i> (L.) Lag. Asteraceae/Compositae	Roots	SRP: 2 (female sterility)	Decoction	Oral	0.136
<i>Artemisia absinthium</i> L. Asteraceae	Aerial parts	Can: 1 GISD: 2 (intestine problems) RTD: 1 (asthma)	Raw Decoction	Oral Oral	0.136
<i>Artemisia campestris</i> L. Asteraceae	Aerial parts	RTD: 2 (bronchitis) GISD: 1 (stomach pain)	Infusion	Oral	0.139
<i>Artemisia herba-alba</i> Asso Asteraceae	Aerial parts	GISD: 7 (stomachache, ulcer)	Decoction	Oral	0.454
<i>Atriplex halimus</i> L. Chenopodiaceae	Seeds Leaves	CSD: 2 (hypertension) RTD: 1 (asthma) Can: 4 (cancers)	Decoction	Oral	0.454
<i>Berberis vulgaris</i> L. Berberidaceae	Roots	CSD: 3 (hypercholesterolemia) GISD: 3 (hydatid cyst) Can: 4 (cancers) CSD: 2 (hypercholesterolemia) GISD: 1 (stomachache)	Decoction	Oral	0.318
<i>Borago officinalis</i> L. Boraginaceae	Aerial parts	GISD: 2 (stomachache)	Decoction	Oral	0.136
<i>Carex arenaria</i> L. Cyperaceae	Roots	RTD: 1 (cold) GISD: 1 (digestive disorders) ESD: 1 (hypertension)	Raw Decoction Decoction	oral Oral Oral	0.090
<i>Carum carvi</i> L. Apiaceae	Seeds	GISD: 4 (stomach, appetite, kids colitis) CSD: 1 (hypertension) RTD: 1 (kids cough)	Decoction Decoction	Oral Oral	0.272
<i>Cassia angustifolia</i> Vahl Fabaceae	Leaves	GISD: 7 (stomachache, constipation, gases) GH: 1 (psychopathic disorders)	Infusion Decoction	Oral	0.363
<i>Cinnamomum camphora</i> (L.) J.Presl Lauraceae	Leaves	GISD: 2 (hemorrhoids)	Raw	Topical	0.136
<i>Cinnamomum cassia</i> (L.) J.Presl Lauraceae	Bark	RTD: 1 (cough) RTD: 1 (respiratory affections) GISD: 1 (stomachache) SRP: 1 (menstrual pains)	Vapor Raw Decoction	Nasal Oral	0.136

(Contd...)

Table 2: (Continued)

Botanical name	Part used	Ailment category: N of use reports	Preparation method	Administration	UV
<i>Citrullus colocynthis</i> (L.) Schrad. Cucurbitaceae	Fruits	GISD: 1 (haemorrhoids)	Raw	Topical	0.045
<i>Cotula cinerea</i> Delile Asteraceae	Whole	RTD: 1 (pharyngitis) GH: 1 (systemic healing) NS: 1 (migraine) GISD: 1 (stomachache)	Raw	Oral	0.181
<i>Cucurbita maxima</i> Duchesne Cucurbitaceae	Seeds	NS: 1 (migraine)	Decoction Raw	Oral Vapor	0.045
<i>Cuminum cyminum</i> L. Apiaceae	Seeds	GISD: 4 (stomachache, gases, constipation) RTD: 1 (kids cough) SRP: 1 (menstrual pain)	Decoction/ Raw Decoction Decoction	Oral	0.272
<i>Cupressus sempervirens</i> L. Cupressaceae	Aerial parts	GISD: 2 (bad digestion, intestine disorders)	Maceration	Oral	0.090
<i>Curcuma longa</i> L. Zingiberaceae	Rizhomes	GISD: 1 (liver diseases)	Decoction	Oral	0.067
<i>Cyperus esculentus</i> L. Cyperaceae	Tuber	GISD: 1 (kids appetite)	Raw	Oral	0.045
<i>Daphne gnidium</i> L. Thymelaeaceae	Leaves	HC: 1 (hair loss)	Raw	Topical	0.046
<i>Eucalyptus globulus</i> Labill. Myrtaceae	Leaves	RTD: 3 (flu, cough)	Vapor	Inhalation	0.136
<i>Ferula communis</i> L. Umbelliferae/ Apiaceae	Aerial parts	SMSD: 1 (fractures)	Decoction	Topical	0.045
<i>Foeniculum vulgare</i> Mill. Umbelliferae/Apiaceae	Seeds	GISD: 5 (stomachache, colitis, gases) CSD: 2 (hypertension) RTD: 1 (cough)	Infusion Raw Decoction	Oral	0.363
<i>Fraxinus angustifolia</i> Vahl Oleaceae	Leaves	RTD: 1 (allergy)	Infusion	Oral	0.045
<i>Globularia alypum</i> L. Globulariaceae	Leaves	GISD: 2 (hepatitis, anaemia) GH: 1 (body purification) HC: 1 (hair loss)	Decoction Raw	Oral Topical	0.181
<i>Glycyrrhiza glabra</i> L. Papilionaceae/Fabaceae	Roots	RTD: 10 (laryngitis, bronchitis, cough) GISD: 1 (appetite)	Infusion/ Raw Raw	Oral Oral	0.500
<i>Haloxylon salicornicum</i> (Moq.) Bunge ex Boiss. Chenopodiaceae	Aerial parts	SD: 3 (wound, infections)	Raw	Topical	0.181
<i>Hibiscus sabdariffa</i> L. Malvaceae	Aerial parts	GH: 1 (pain) CSD: 1 (hypertension)	Decoction	Oral	0.045
<i>Hyoscyamus niger</i> L. Solanaceae	Leaves	SD: 1 (eczema)	Raw	Topical	0.045
<i>Juglans regia</i> L. Juglandaceae	Fruits	GISD: 1 (obesity)	Infusion	Oral	0.045
<i>Juniperus phoenicea</i> L. Cupressaceae	Leaves	GISD: 9 (stomach pain, gases) CSD: 1 (heart disease) RTD: 1 (apnoea)	Decoction Raw Decoction	Oral	0.500
<i>Laurus nobilis</i> L. Lauraceae	Leaves	GISD: 2 (digestive disorders)	Infusion	Oral	0.181
<i>Lavandula latifolia</i> Medik. Lamiaceae	Flowers	CSD: 2 (hypertension) SRP: 3 (female sterility, lactogene)	Decoction Raw/ Decoction Decoction	Oral	0.272
<i>Lavandula stoechas</i> L. Lamiaceae	Leaves	RTD: 2 (kids cough) GISD: 1 (gases) ESD: 1 (diabetes) CSD: 1 (hypercholesterolemia)	Infusion	Oral	0.090
<i>Lawsonia inermis</i> L. Lythraceae	Leaves	HC: 3 (hair loss) KD: 1 (cystitis) SD: 1 (infections)	Raw Decoction	Topical Oral	0.272
<i>Lepidium sativum</i> L. Cruciferae/Brassicaceae	Seeds	GH: 1 (general pain) RSD: 2 (bronchitis) ESD: 1 (diabetes) CSD: 1 (hypertension) SMSD: 1 (rheumatism)	Infusion Raw Decoction	Oral Oral Topical	0.363

(Contd...)

Table 2: (Continued)

Botanical name	Part used	Ailment category: N of use reports	Preparation method	Administration	UV
	Whole	Can: 1 RTD: 1 (cold) SRP: 1 (gynecological problems)	Raw	Oral	
<i>Linum usitatissimum</i> L. Linaceae	Seeds	GISD: 3 (digestive disorders)	Raw	Oral	0.363
<i>Lippia citriodora</i> (Palau) Kunth Verbenaceae	Leaves	CSD: 2 (hypertension) RTD: 2 (allergy) ESD: 1 (diabetes) GISD: 1 (colitis)	Infusion	Oral	0.045
<i>Lupinus albus</i> L. Fabaceae/Leguminosae	Seeds	ESD: 4 (diabetes)	Raw	Oral	0.181
<i>Marrubium vulgare</i> L. Lamiaceae	Aerial parts	SMSD: 1 (arthritis)	Decoction	Topical	0.045
<i>Matricaria discoidea</i> DC. Asteraceae/compositae	Aerial parts	RTD: 1 (cold)	Decoction	Oral	0.046
<i>Mentha pulegium</i> L. Lamiaceae	Aerial parts	RTD: 3 (cough, Flu)	Infusion	Oral	0.227
<i>Myrtus communis</i> L. Myrtaceae	Seeds	GISD: 1 (appetite) CSD: 1 (cardiac diseases) GISD: 4 (gases, parasites) RTD: 1 (flu)	Decoction Decoction Decoction	Oral Oral	0.227
<i>Nerium oleander</i> L. Apocynaceae	Leaves	SD: 1 (furuncle)	Raw	Topical	0.045
<i>Nigella sativa</i> L. Ranunculaceae	Seeds	RTD: 4 (cough, bronchitis) GH: 2 (systemic healing)	Raw Decoction	Oral	0.181
<i>Ocimum basilicum</i> L. Lamiaceae	Leaves	RTD: 4 (allergy, cough) NS: 2 (sedative) ESD: 1 (goitre)	Decoction	Oral	0.318
<i>Origanum majorana</i> L. Lamiaceae	Leaves	NS: 3 (sedative, migraine) RTD: 2 (allergy, cough, flu) GISD: 2 (obesity)	Decoction Raw	Oral	0.363
<i>Ormenis nobilis</i> (L.) J. Gay ex Coss. & Germ. Asteraceae	Flowers	SD: 3 (wounds)	Decoction	Oral	0.227
<i>Parietaria officinalis</i> L. Urticaceae	Leaves	SMDS: 2 (rheumatism) KD: 4 (kidney stones)	Decoction/ Vapor	Oral Inhalation	0.181 0.136
<i>Peganum harmala</i> L. Zygophyllaceae	Roots	NS: 2 (dementia, depression)			
<i>Pimpinella anisum</i> L. Apiaceae	Seeds Seeds	GISD: 1 (parasites) GISD: 4 (gases, colitis) RTD: 3 (kids bronchitis, cough)	Decoction Raw Decoction	Oral Oral	0.410
<i>Pinus halepensis</i> Mill. Pinaceae	Leaves	CSD: 2 (hypertension) GISD: 2 (stomachache) CSD: 1 (hypertension)	Decoction Decoction Decoction	Oral Oral	0.093
<i>Pinus maritima</i> Mill. Pinaceae	Leaves	RTD: 1 (flu)	Raw	Inhalation	0.046
<i>Pistacia lentiscus</i> L. Anacardiaceae	Leaves	GISD: 5 (stomachache, colitis)	Raw/ decoction	Oral	0.363
<i>Prunus persica</i> (L.) Batsch Rosaceae	Leaves	SD: 2 (skin diseases) RTD: 1 (bronchitis) Can: 4 (cancers)	Raw Infusion Raw/ decoction	Topical Oral Oral	0.227
<i>Quercus infectoria</i> G. Olivier Fagaceae	Aerial parts	GISD: 1 (colon) GISD: 4 (ulcer, hemorrhoids)	Decoction Raw	Oral	0.181
<i>Rhamnus alaternus</i> L. Rhamnaceae	Leaves	SD: 1 (wounds) GISD: 3 (hepatitis)	Maceration Decoction	Topical Oral	0.136
<i>Rhamnus purshiana</i> DC. Rhamnaceae	Barks	RTD: 2 (pharyngitis)	Raw	Topical	0.093
<i>Rosa canina</i> L. Rosaceae	Flowers	RTD: 1 (cough)	Decoction	Oral	0.045
<i>Rosmarinus officinalis</i> L. Lamiaceae	Leaves	SRP: 5 (menstrual problems) CSD: 3 (hypertension) NS: 2 (memory) Fev: 1 (fever)	Decoction Infusion Decoction	Oral Oral Oral	0.545
<i>Rubia tinctoria</i> Salisb. Rubiaceae	Roots	GISD: 1 (stomachache) GISD: 1 (Anaemia)	Decoction	Oral	0.045

(Contd...)

Table 2: (Continued)

Botanical name	Part used	Ailment category: N of use reports	Preparation method	Administration	UV
<i>Ruta chalepensis</i> L. Rutaceae	Leaves	GISD: 4 (intestine disorders, liver problems) NS: 2 (vertigo) ESD: 2 (diabetes) SMSD: 1 (gout)	Infusion Decoction Infusion infusion	Oral Oral Oral Oral	0.409
<i>Salvia officinalis</i> L. Lamiaceae	Flowers	GISD: 3 (digestive disorders) SRP: 2 (ovary inflammation, menstrual problems) CSD: 1 (hypertension)	Decoction	Oral	0.272
<i>Satureja calamintha</i> (L.) Scheele Lamiaceae	Leaves	Fev: 1 (fever)	Maceration	Oral	0.090
<i>Sesamum indicum</i> L. Pedaliaceae	Seeds	GISD: 1 (stomachache) NS: 1 (memory strength)	Decoction Raw	Oral Oral	0.045
<i>Stipa tenacissima</i> L. Poaceae/ Graminaceae	Whole	GISD: 1 (weight loss)	Decoction	Oral	0.045
<i>Teucrium polium</i> L. Lamiaceae	Leaves	GISD : 1 (gases)	Decoction	Oral	0.045
<i>Thymelaea hirsuta</i> (L.) Endl. Thymelaeaceae	Aerial parts	SRP : 2 (female sterility)	Vapor	Topical	0.090
<i>Thymus vulgaris</i> L. Lamiaceae	Whole	RTD :16 (bronchitis, laryngitis, allergy, flu, cough) GISD: 4 (colon disorders, diarrhoea) CSD: 2 (hypertension) ESD: 1 (diabetes)	Decoction Infusion Decoction	Oral Oral Oral	1.045
<i>Thypha angustifolia</i> L. Typhaceae	Seeds	GISD: 2 (haemorrhoids) Fev: 1 (fever)	Raw Decoction	Topical Oral	0.136
<i>Trigonella foenum-graecum</i> L. Fabaceae/Leguminoseae	Seeds	GISD: 5 (appetite, hepatitis)	Decoction	Oral	0.590
<i>Triticum durum</i> Desf. Poaceae/ Graminaceae	Seeds	GH: 4 (tonic) ESD: 2 (diabetes) CSD: 1 (hypertension) IS: 1 (increasing immunity) GISD: 1 (colon)	Raw Infusion Raw Decoction Raw	Oral	0.045
<i>Triticum repens</i> L. Poaceae/ Graminaceae	Roots	KD: 3 (diuretic) Can: 3 (cancer) GH: 1 (tonic)	Decoction	Oral	0.318
<i>Tussilago farfara</i> L. Asteraceae	Leaves	RTD :1 (cough)	Decoction	Oral	0.045
<i>Urtica dioica</i> L. Urticaceae	Aerial parts	GISD: 3 (weight gain, anemia) ESD: 2 (diabetes)	Decoction	Oral	0.227
<i>Viscum album</i> L. Loranthaceae	Leaves	SRP: 2 (breast milk secretion) SMSD: 2 (fractures)	Raw	Oral	0.181
<i>Vitex agnus-castus</i> L. Lamiaceae	Leaves Stems	SRP: 2 (internal uterine cold)	Raw	Oral	0.090
<i>Zingiber officinale</i> Roscoe Zingiberaceae	Roots	RTD: 9 (cough, flu, allergies) GH: 4 (systemic problems) GISD: 2 (digestive disorders, liver diseases) CSD: 2 (cardiac diseases) SRP: 2 (aphrodisiac)	Infusion/ Mac Maceration Decoction Raw	Oral Oral Oral Oral Oral	0.863
<i>Ziziphus lotus</i> (L.) Lam. Rhamnaceae	Roots	ESD: 1 (diabetes)	Infusion	Oral	0.318
	Fruits	HC: 1 (hair loss) KD: 4 (renal disorders, renal calculi)	Raw Raw/ decoction	Topical Oral	
<i>Zygophyllum cornutum</i> Coss. Zygophylaceae	Leaves	SRP: 1 (infections) GISD: 1 (stomachache) ESD: 1 (diabetes)	Decoction Decoction	Topical Oral	0.090

KD: Kidney diseases, GISD: Gastrointestinal system diseases, SD: Skin diseases, ESD: Endocrine system diseases, RTD: Respiratory tract diseases, SMSD: Skeleto-muscular system disorders, CSD: Cardiovascular system diseases, GH: General health, HC: Health care, NS: Nervous system, SRP: Sexual-reproductive problems

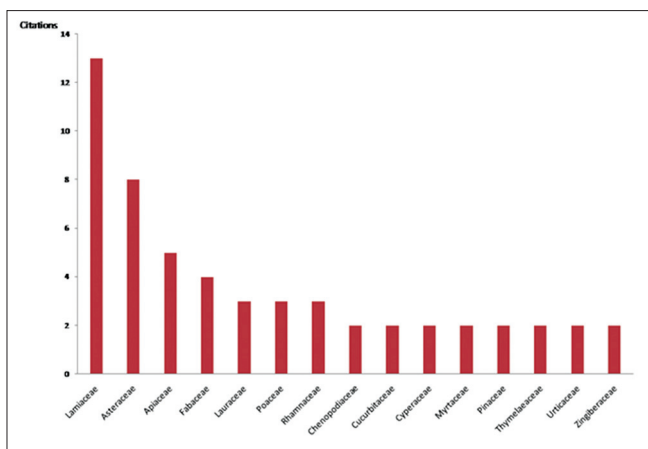


Figure 2: Distribution of reported species among the botanical families

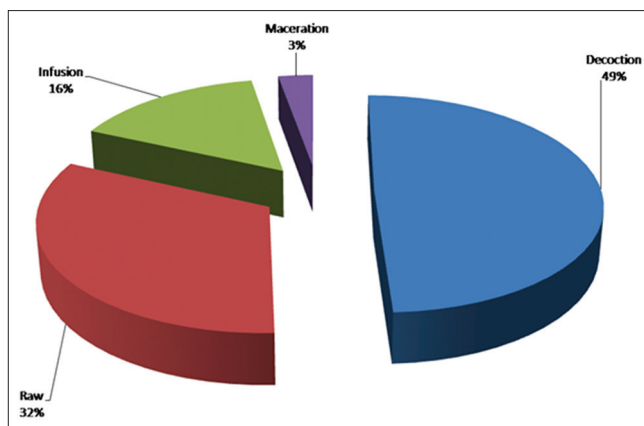


Figure 4: Modes of preparation used by traditional healers

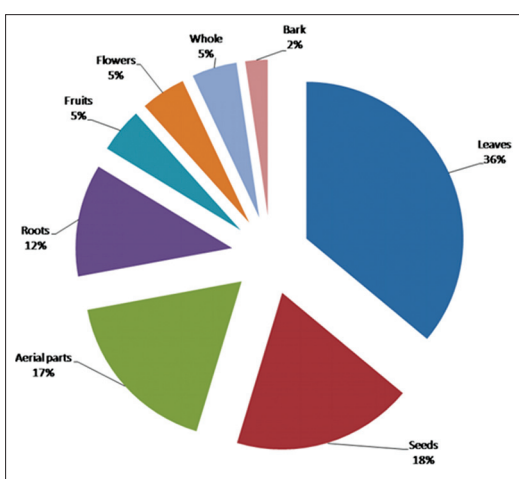


Figure 3: Plant parts used by traditional healers

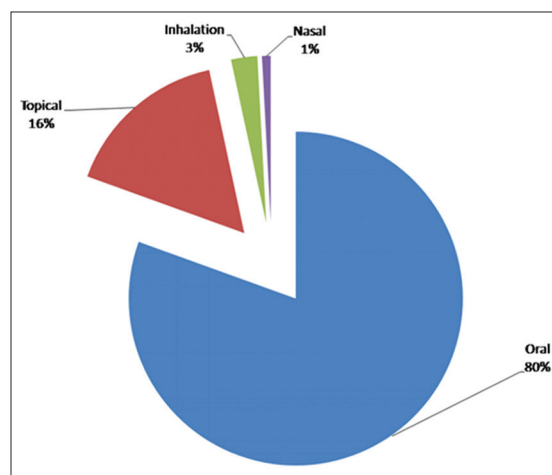


Figure 5: Routes of administration

administered orally (80%). Furthermore, as shown in Table 3, out of the 83 cited plants, 45 species are administered with other ingredients such as other plants (66%) or non-plant-advants (34%) such as olive oil, honey, milk, sugar, yogurt, or eggs. Honey is the adjuvant most added to different herbal remedies in South-west of Algeria (53%). Regarding the treated ailments, 35 species are reported to be used to treat more than one disease. According to our results [Figure 6], gastrointestinal disorders were the most commonly treated ailments with medicinal plants in south-west Algeria (33.6%), they were followed by respiratory diseases (23%) and cardiovascular diseases (9%).

Quantitative Analysis

UV of cited plants ranged from 0.045 to 1.045. The most commonly used species were *Thymus vulgaris* L. (UV = 1.045), *Zingiber officinale* Roscoe (UV = 0.863), *Trigonella foenum-graecum* L. (UV = 0.590), *Rosmarinus officinalis* L. (UV = 0.545), *Ruta chalepensis* L. (UV = 0.5), *Glycyrrhiza glabra* L. (UV = 0.5), *A. herba-alba* Asso (UV = 0.545), *Atriplex halimus* L. (UV = 0.545), and *Pimpinella anisum* L. (UV = 0.41).

The FIC reflects homogeneity of information provided by different informants regarding medicinal species used to treat a

category of ailments. High FIC is correlated to species could be efficient in treating particular ailment [13]. Therefore, species with high FIC are to be prioritized for further pharmacological and phytochemical studies. As shown in Table 4, the highest FIC were found for kidney (0.727), cancer (0.687), digestive (0.603) and respiratory diseases (0.627). Four species are used to treat kidney diseases (KD) by local healers in South-west Algeria: *Lawsonia inermis* L. (topical use of leaves to treat cystitis), *Parietaria officinalis* L. (decoction of leaves is taken orally to treat kidney stones), *Triticum repens* L. (decoction of roots is used orally as diuretic) and *Ziziphus lotus* (L.) Lam. (fruits taken orally).

Cancer is ranked second regarding the FIC, demonstrating that local pharmacopeia could provide species with promising anticancer activities. Six species are used to treat different cancers: Roots of *Anacyclus pyrethrum* (L.) Lag., *T. repens* L. and *Berberis vulgaris* L., the whole *Lepidium sativum* L., seeds of *A. halimus* L. and leaves of *Prunus persica* (L.) Batsch.

To determine the most frequent species used for each ailment category, we calculated the FL. According to our results [Table 5], four species had the highest FL of 100%: *Eucalyptus globulus* Labill. (leave's vapor is inhaled for a cough and

Table 3: Ingredients added for the preparation of herbal medicines by the local traditional healers

Botanical name	Other plants added in medicinal preparation	Other ingredients added
<i>Acacia gummifera</i> Willd.	<i>Anacyclus pyrethrum</i> (L.) Lag. <i>Glycyrrhiza glabra</i> L. <i>Lepidium sativum</i> L. <i>Nigella sativa</i> L. <i>Vitex agnus-castus</i> L. <i>Zingiber officinale</i> Roscoe	Honey
<i>Ammoides pusilla</i> (Brot.) Breistr. L.	<i>Citrus limon</i> (L.) Osbeck	Yoghurt
<i>Anacyclus pyrethrum</i> (L.) Lag.	<i>Acacia gummifera</i> Willd. <i>Aristolochia longa</i> L. <i>Berberis vulgaris</i> L. <i>Lepidium sativum</i> L. <i>Vitex agnus-castus</i> L. <i>Zingiber officinale</i> Roscoe	Milk Honey
<i>Aristolochia longa</i> L.	<i>Berberis vulgaris</i> L. <i>Haloxylon salicornicum</i> (Moq.) Bunge ex Boiss.	Honey
<i>Berberis vulgaris</i> L.	<i>Prunus persica</i> (L.) Batsch <i>Aristolochia longa</i> L. <i>Prunus persica</i> (L.) Batsch	Honey
<i>Carex arenaria</i> L. <i>Carum carvi</i> L.	<i>Pinus halepensis</i> Mill. <i>Foeniculum vulgare</i> Mill. <i>Lavandula latifolia</i> Medik. <i>Pimpinella anisum</i> L.	
<i>Cinnamomum camphora</i> (L.) J.Presl <i>Cinnamomum cassia</i> (L.) J.Presl		Olive oil Milk honey
<i>Citrullus colocynthis</i> (L.) Schrad.		Olive oil
<i>Cuminum cyminum</i> L.	<i>Carum carvi</i> L. <i>Foeniculum vulgare</i> Mill. <i>Lavandula latifolia</i> Medik. <i>Pimpinella anisum</i> L. <i>Ruta chalepensis</i> L.	
<i>Cyperus esculentus</i> L.	<i>Linum usitatissimum</i> L.	Honey Milk
<i>Daphne gnidium</i> L. <i>Foeniculum vulgare</i> Mill.	<i>Lawsonia inermis</i> L. <i>Carum carvi</i> L. <i>Cuminum cyminum</i> L. <i>Lavandula latifolia</i> Medik. <i>Linum usitatissimum</i> L. <i>Pimpinella anisum</i> L. <i>Teucrium polium</i> L. <i>Trigonella foenum-graecum</i> L.	Honey
<i>Glycyrrhiza glabra</i> L.	<i>Acacia gummifera</i> Willd. <i>Linum usitatissimum</i> L. <i>Nigella sativa</i> L.	Honey Milk
<i>Haloxylon salicornicum</i> (Moq.) Bunge ex Boiss.	<i>Lawsonia inermis</i> L.	Olive oil
<i>Hyoscyamus niger</i> L. <i>Juniperus phoenicea</i> L.	<i>Allium cepa</i> L. <i>Lawsonia inermis</i> L. <i>Punica granatum</i> L.	Honey
<i>Lavandula latifolia</i> Medik.	<i>Anacyclus pyrethrum</i> (L.) Lag. <i>Carum carvi</i> L. <i>Cuminum cyminum</i> L. <i>Foeniculum vulgare</i> Mill. <i>Teucrium polium</i> L. <i>Origanum majorana</i> L.	Honey

(Contd...)

Table 3: (Continued)

Botanical name	Other plants added in medicinal preparation	Other ingredients added
<i>Lepidium sativum</i> L.	<i>Lawsonia inermis</i> L. <i>Linum usitatissimum</i> L. <i>Zingiber officinale</i> Roscoe	Honey Milk
<i>Linum usitatissimum</i> L.	<i>Cyperus esculentus</i> L. <i>Foeniculum vulgare</i> Mill. <i>Glycyrrhiza glabra</i> L. <i>Lepidium sativum</i> L. <i>Pimpinella anisum</i> L. <i>Trigonella foenum-graecum</i> L. <i>Zingiber officinale</i> Roscoe	Honey Sugar
<i>Lupinus albus</i> L. <i>Marrubium vulgare</i> L. <i>Mentha pulegium</i> L.	<i>Artemisia herba-alba</i> Asso <i>Citrus limon</i> L.	Honey Olive oil Milk
<i>Nigella sativa</i> L.	<i>Acacia gummifera</i> Willd. <i>Glycyrrhiza glabra</i> L.	Honey
<i>Origanum majorana</i> L.	<i>Lavandula latifolia</i> Medik.	Honey Olive oil Honey
<i>Parietaria officinalis</i> L. <i>Pimpinella anisum</i> L.	<i>Carum carvi</i> L. <i>Cuminum cyminum</i> L. <i>Foeniculum vulgare</i> Mill. <i>Lavandula latifolia</i> Medik. <i>Linum usitatissimum</i> L. <i>Carex arenaria</i> L.	
<i>Pinus halepensis</i> Mill. <i>Pinus maritima</i> Mill.		Honey Olive oil
<i>Pistacia lentiscus</i> L.	<i>Juniperus phoenicea</i> L.	Honey Milk Olive oil Honey
<i>Prunus persica</i> (L.) Batsch	<i>Aristolochia longa</i> L. <i>Berberis vulgaris</i> L. <i>Haloxylon salicornicum</i> (Moq.) Bunge ex Boiss.	Honey
<i>Quercus infectoria</i> G.Olivier		Honey
<i>Rhamnus alaternus</i> L. <i>Rosa canina</i> L. <i>Rubia tinctoria</i> Salisb. <i>Ruta chalepensis</i> L.	<i>Cuminum cyminum</i> L. <i>Mentha pulegium</i> L.	Honey Honey Honey
<i>Satureja calamintha</i> (L.) Scheele <i>Sesamum indicum</i> L. <i>Teucrium polium</i> L.		Honey
<i>Thymus vulgaris</i> L.	<i>Foeniculum vulgare</i> Mill. <i>Lavandula latifolia</i> Medik. <i>Mentha pulegium</i> L. <i>Punica granatum</i> L.	Eggs Milk
<i>Trigonella foenum-graecum</i> L.	<i>Foeniculum vulgare</i> Mill. <i>Linum usitatissimum</i> L. <i>Pimpinella anisum</i> L.	Honey Milk
<i>Viscum album</i> L.		Honey Milk Sugar
<i>Vitex agnus-castus</i> L.	<i>Acacia gummifera</i> Willd. <i>Lepidium sativum</i> L. <i>Zingiber officinale</i> Roscoe	
<i>Ziziphus lotus</i> (L.) Lam.		Olive oil

flu), *Lupinus albus* L. (seeds are taken orally for diabetes), *P. officinalis* L. (oral administration of leave's decoction for kidney stones), and *Rhamnus alaternus* L. (leave's decoction taken orally for the treatment of hepatitis). As shown in our

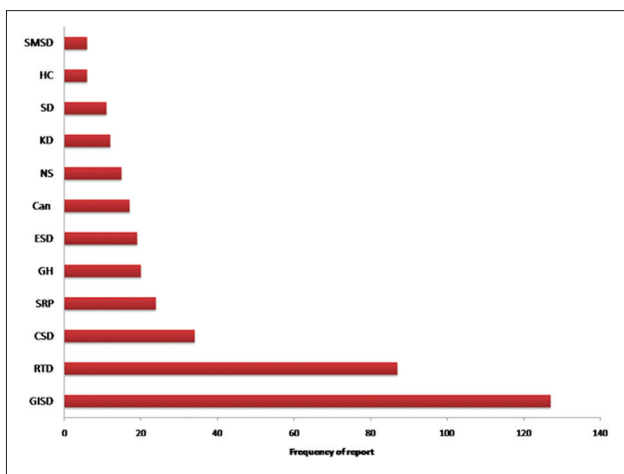


Figure 6: Ailments treated by the reported species. KD: Kidney diseases, GISD: Gatsro-intestinal system diseases, SD: Skin diseases, Can: Cancer, ESD: Endocrine system diseases, RTD: Respiratory tract diseases, SMSD: Skeleto-muscular system disorders, CSD: Cardiovascular system diseases, GH: General health, HC: Health care, NS: Nervous system, SRP: Sexual-reproductive problems

results, seeds of *L. albus* L. are commonly used (as raw) to treat diabetes.

DISCUSSION

In this study, we report the use of 83 medicinal species belonging to 38 families. These findings are in line with those we published recently [7]. Local healers in both North-west and South-West of Algeria reflect that ancestral knowledge is very important with regard to the use of medicinal plants as complementary or alternative medicine. Our results showed that the most predominant families were Lamiaceae, Asteraceae, Apiaceae, and Fabaceae. Same results were reported in oriental Morocco, a region sharing with the study area most of climatic, demographic and geographical characteristics [14]. Furthermore, the predominance of Lamiaceae and Asteraceae is well documented in most of the ethnobotanical studies carried out in North African regions such as Algeria [15,16], Morocco [17], or Egypt [18]. Recently, Ramdane *et al.* [8] found that Lamiaceae followed by Asteraceae were the most predominant families of medicinal species used by the *Touareg* called “blue men of the Sahara” in extreme South of Algeria. Furthermore, leaves were the most frequent used plant parts. Recently, Benderradji *et al.* [19] demonstrated that in South-east of Algeria, leaves were the most commonly used parts in the treatment of different ailments. The predominance of leaves in herbal therapies may be attributed to their abundance in the region, and their richness in secondary metabolites produced by photosynthesis. On the other hand, a collection of leaves would be much easier and sustainable than that of roots or flowers [20].

According to our results, the decoction was found to be the major mode of preparation of the reported medicinal species. Similar findings were recently reported in South-east of Algeria (region of Ouargla) [21]. Decoction and infusion are highly valued and often preferred by local healers in Africa [22].

Table 4: FIC for commonly used medicinal plants

Ailment	Nur	Nt	FIC
KD	12	4	0.727
Cancer	17	6	0.687
RTD	87	33	0.627
GISD	127	51	0.603
SRP	24	12	0.521
SD	11	6	0.5
NS	15	9	0.428
GH	20	12	0.421
HC	6	4	0.4
CSD	34	21	0.393
ESD	19	13	0.333
SMSD	6	5	0.2

KD: Kidney diseases, GISD: Gatsro-intestinal system diseases, SD: Skin diseases, ESD: Endocrine system diseases, RTD: Respiratory tract diseases, SMSD: Skeleto-muscular system disorders, CSD: Cardiovascular system diseases, GH: General health, HC: Health care, NS: Nervous system, SRP: Sexual-reproductive problems

Table 5: FL values for common medicinal plants used

Ailment	Plants	FL (%) category	
RTD	<i>Eucalyptus globulus</i> Labill.	100	
	<i>Glycyrrhiza glabra</i> L.	91	
	<i>Acacia gummifera</i> Willd.	85.71	
	<i>Nigella sativa</i> L.	66.66	
	<i>Thymus vulgaris</i> L.	69.56	
	<i>Mentha pulegium</i> L.	60	
SD	<i>Ocimum basilicum</i> L.	57	
	<i>Haloxylon salicornicum</i> (Moq.) Bunge ex Boiss.	75	
	<i>Ormenis nobilis</i> (L.) J. Gay ex Coss. & Germ.	60	
	SRP	<i>Anacyclus pyrethrum</i> (L.) Lag.	66.66
		ESD	<i>Lupinus albus</i> L.
NS	<i>Peganum harmala</i> L.	66.66	
KDs	<i>Parietaria officinalis</i> L.	100	
	<i>Zygophyllum cornutum</i> Coss.	80	
GISD	<i>Rhamnus alaternus</i> L.	100	
	<i>Cassia angustifolia</i> Vahl	87.5	
	<i>Juniperus phoenicea</i> L.	81.81	
	<i>Myrtus communis</i> L.	80	
	<i>Artemisia herba-alba</i> Asso	70	
	<i>Ajuga iva</i> (L.) Schreb.	66.66	
	<i>Borago officinalis</i> L.	66.66	
	<i>Carum carvi</i> L.	66.66	
	<i>Cinnamomum camphora</i> (L.) J. Presl	66.66	
	<i>Cuminum cyminum</i> L.	66.66	
	<i>Pinus halepensis</i> Mill.	66.66	
	<i>Thypha angustifolia</i> L.	66.66	
	<i>Foeniculum vulgare</i> Mill.	62.5	
	<i>Pistacia lentiscus</i> L.	62.5	
<i>Urtica dioica</i> L.	60		
Cancer	<i>Prunus persica</i> (L.) Batsch	80	
	<i>Berberis vulgaris</i> L.	57.14	

KD: Kidney diseases, GISD: Gatsrointestinal system diseases, SD: Skin diseases, ESD: Endocrine system diseases, RTD: Respiratory tract diseases, NS: Nervous system, SRP: Sexual-reproductive problems

Although our results are consistent with those we found in North-west of Algeria [7] and those reported in neighboring countries such as Morocco [23], we noticed that medicinal plants are never used as a paste in the region. In line with this, Moussaoui *et al.* [24] reported that in Mekenes (Morocco), paste was never used in administration of different herbal

formulations. The predominance of oral administration of the different medicinal plants in South-west Algeria is in total agreement with most of the carried out ethnobotanical studies in the country [25,26]. The predominance of oral administration may be explained by a high incidence of internal ailments in the region [5]. On the other hand, it's thought that oral route is the most acceptable for the patient. 45 species are administered with other plants - (66%) or nonplants-adjuvants. Honey was added in 53% of herbal formulations. Indeed, honey is considered sacred to Muslims and occupies an important place in Islamic medicine [27]. Furthermore, honey is considered as an instant energy source and is often used in Algeria to improve the acceptability of plants having a bitter taste unbearable [7]. In addition, we found that digestive and respiratory diseases were the most commonly treated ailments with medicinal plants. Our results corroborate those reported by Meddour *et al.* [28] showing that digestive and respiratory diseases were the predominant ailments treated by local populations using medicinal plants of Kabylia (North-west of Algeria). Similar findings were reported in Beni-Souif (Egypt) [29].

Our quantitative analysis showed that *T. vulgaris* L., *Z. officinale* Roscoe, *T. foenum-graecum* L., and *R. officinalis* L. were the most commonly used species with the highest UVs. *T. vulgaris* L., *Z. officinale* Roscoe, and *T. foenum-graecum* L. were found to be the most used species in North-west Algeria [7]. Our results demonstrate that both North and South regions of West Algeria present high level of similarities regarding the ethnomedicinal knowledge. The two regions share some social and environmental characteristics. Indeed, most of the local healers working in North-west Algeria are from the South-west. Recently, Mikou *et al.* found that *T. vulgaris* L., *R. officinalis* L., and *Artemisia herba-alba* Asso were the species most commonly used by local populations in Fes (Morocco) [30]. In the current study, the decoction of *T. vulgaris* L. is reported to be mainly (70%) used in the treatment of respiratory diseases such as bronchitis, laryngitis, allergy, flu, and cough. The plant is considered one of the most important antitussive herbal treatments in North Algeria [31]. The pharmacological properties of the plant have been attributed to a variety of active metabolites such as apigenin, luteolin, p-cymene, borneol, carvacrol, cymol, linalool, thymol, and triterpenic acids [32].

The high UV of *Z. officinale* Roscoe was reported in most of the ethnobotanical studies in muslim communities and may be explained by the influence of Islamic traditional medicine since the plant is mentioned in Holy Quran [33].

According to the calculated FIC, cancer is ranked second and is reported to be treated using six species: *A. pyrethrum* (L.) Lag., *T. repens* L., *Berberis vulgaris* L., *L. sativum* L., *A. halimus* L., and *P. persica* (L.) Batsch. Increasing incidence of different cancers in Algeria is well documented [34]. We have recently demonstrated that about 50% of Algerian cancer patients use different medicinal plants to treat and/or manage their illness [25,35].

FL is a useful indicator for identifying the informants' most preferred species in use for treating different disorders [36]. *E.*

globulus Labill., *L. albus* L., *P. officinalis* L., and *R. alaternus* L. had the highest FL values of 100%. In line with our results, *E. globulus* Labill. has been reported to possess higher FL for respiratory diseases [37,38]. Furthermore, seeds of *L. albus* L. are used to treat diabetes.

Indeed, Knecht *et al.* demonstrated that extracts of the whole seeds resulted in a significant increasing of tolerance to an oral glucose bolus. Furthermore, the extract exhibited a marked antihyperglycemic activity [39]. The antidiabetic effect of the plant may be attributed to the presence of an active protein: Conglutin- γ . The latter has shown *in vitro* insulin-mimetic effects [40,41].

CONCLUSION

In total, 83 medicinal plants species belonging to 38 families were reported to be used by traditional healers from South-west of Algeria. Our results showed important similarities with findings we previously reported from North-west of Algeria. Plants with high UV could be a promising source of active compounds against several ailments. Similarly, the plants with highest FL were identified and should be further studied regarding their phytochemicals and their biological activities. Furthermore, local healers from South-west Algeria demonstrated high consensus regarding treatment of KD and cancer.

ACKNOWLEDGMENT

The author is grateful to Adrar and Bechar departments' local healers for sharing their ancestral knowledge throughout the present study.

REFERENCES

1. Thomford NE, Dzobo K, Chopera D, Wonkam A, Skelton M, Blackhurst D, *et al.* Pharmacogenomics implications of using herbal medicinal plants on African populations in health transition. *Pharmaceuticals (Basel)* 2015;8:637-63.
2. Chege IN, Okalebo FA, Guantai AN, Karanja S, Derese S. Herbal product processing practices of traditional medicine practitioners in Kenya-key informant interviews. *J Health Med Nurs* 2015;16:11-23.
3. Prasad S, Tyagi AK. Traditional medicine: The goldmine for modern drugs. *Adv Tech Biol Med* 2015;3:1-2.
4. Rates SM. Plants as source of drugs. *Toxicon* 2001;39:603-13.
5. Polat R, Satil F. An ethnobotanical survey of medicinal plants in Edremit Gulf (Balikesir-Turkey). *J Ethnopharmacol* 2012;139:626-41.
6. Vasisht K, Kumar V. *Compendium of Medicinal and Aromatic Plants*. Vol. 1. Africa: ICS-UNIDO, Trieste; 2004. p. 23-56.
7. Benarba B, Belabid L, Righi K, Bekkar AA, Elouiissi M, Khaldi A, *et al.* Study of medicinal plants used by traditional healers in Mascara (North West of Algeria). *J Ethnopharmacol* 2015;175:626-37.
8. Ramdane F, Hadj Mahammed M, Didi Ould Hadj M, Chanai A, Hammoudi R, Hillali N, *et al.* Ethnobotanical study of some medicinal plants from Hoggar, Algeria. *J Med Plants Res* 2015;9:820-7.
9. Azzi R, Djaziri R, Lahfa F, Sekkal FZ, Benmehdi H, Belkacem N. Ethnopharmacological survey of medicinal plants used in the traditional treatment of diabetes mellitus in the North Western and South Western Algeria. *J Med Plants Res* 2012;6:2041-50.
10. Djellouli M, Moussaoui A, Benmehdi H, Ziane L, Belabbes A, Badraoui M, *et al.* Ethnopharmacological study and phytochemical screening of three plants (*Asteraceae* family) from the region of south West Algeria. *Asian J Nat Appl Sci* 2013;2:59-65.

11. Musa MS, Abdelrasool FE, Elsheikh EA, Ahmed L, Mahmoud AE, Yagi SM. Ethnobotanical study of medicinal plants in the Blue Nile State, South-Eastern Sudan. *J Med Plants Res* 2011;5:4287-97.
12. Yabesh JE, Prabhu S, Vijayakumar S. An ethnobotanical study of medicinal plants used by traditional healers in silent valley of Kerala, India. *J Ethnopharmacol* 2014;154:774-89.
13. Uddin MZ, Hassan A. Determination of informant consensus factor of ethnomedicinal plants used in Kalenga forest, Bangladesh. *Bangladesh J Plant Taxon* 2014;21:83-91.
14. Jamila F, Mostafa E. Ethnobotanical survey of medicinal plants used by people in Oriental Morocco to manage various ailments. *J Ethnopharmacol* 2014;154:76-87.
15. Boudjelal A, Henchiri C, Sari M, Sarri D, Hendel N, Benkhaled A, *et al.* Herbalists and wild medicinal plants in M'Sila (North Algeria): An ethnopharmacology survey. *J Ethnopharmacol* 2013;148:395-402.
16. Sarri M, Mouyet FZ, Benziane M, Cheriet A. Traditional use of medicinal plants in a city at steppic character (M'sila, Algeria). *J Pharm Pharmacogn Res* 2014;2:31-5.
17. Benkhniguel O, Zidane L, Fadli M, Elyacoubi H, Rochdi A, Douira A. Etude ethnobotanique des plantes médicinales dans la région de Mechraâ Bel Ksiri (Région du Gharb du Maroc). *Acta Bot Barc* 2010;53:191-216.
18. Pieroni A, Giusti ME, de Pasquale C, Lenzarini C, Censorii E, González-Tejero MR, *et al.* Circum-mediterranean cultural heritage and medicinal plant uses in traditional animal healthcare: A field survey in eight selected areas within the RUBIA project. *J Ethnobiol Ethnomed* 2006;2:16.
19. Benderradji L, Rebbas K, Ghabbane M, Bounar R, Brini F, Bouzerzour H. Ethnobotanical study of medicinal plants in Jebel Messaad region (M'sila, Algeria). *Glob J Res Med Plants Indig Med* 2015;3:445-59.
20. Offiah NV, Makama S, Elisha IL, Makoshi MS, Gotep JG, Dawurung CJ, *et al.* Ethnobotanical survey of medicinal plants used in the treatment of animal diarrhoea in Plateau State, Nigeria. *BMC Vet Res* 2011;7:36.
21. Hadjadj S, Bayoussef Z, El Hadj-Khelil AO, Beggat H, Bouhafz Z, Boukaka Y, *et al.* Ethnobotanical study and phytochemical screening of six medicinal plants used in traditional medicine in the Northeastern Sahara of Algeria (area of Ouargla). *J Med Plants Res* 2015;9:1049-59.
22. Olajuyigbe OO, Afolayan AJ. Ethnobotanical survey of medicinal plants used in the treatment of gastrointestinal disorders in the Eastern Cape province, South Africa. *J Med Plants Res* 2012;6:3415-24.
23. Daoudi A, Bammou M, Zarkani S, Slimani I, Ibijbijen J, Nassiri L. Ethnobotanical study of medicinal flora in rural municipality of Aguelmouss - Khenifra province – (Morocco). *Phytothérapie* 2015. DOI 10.1007/s10298-015-0953-z.
24. Moussaoui, F, Alaoui T, Aoudry S. Census ethnobotanical study of some plants used in traditional medicine in the city of Meknes. *Am J Plant Sci* 2014;5:2480-96.
25. Chermat S, Gharzouli R. Ethnobotanical study of medicinal flora in the North East of Algeria - An empirical knowledge in Djebel Zdimm (Setif). *J Mater Sci Eng* 2015;5:50-9.
26. Benarba B, Meddah B, Tir Touil A. Response of bone resorption markers to *Aristolochia longa* intake by Algerian breast cancer postmenopausal women. *Adv Pharmacol Sci* 2014;2014:820589.
27. Al-Rawi S, Fetters MD. Traditional Arabic & Islamic medicine: A conceptual model for clinicians and researchers. *Glob J Health Sci* 2012;4:164-9.
28. Meddour R, Meddour OS, Derridj A. Medicinal plants and their traditional uses in Kabylie (Algeria): An ethnobotanical survey. *Planta Med* 2011;77:PF29.
29. Abouzid SF, Mohamed AA. Survey on medicinal plants and spices used in Beni-Suef, Upper Egypt. *J Ethnobiol Ethnomed* 2011;7:1-6.
30. Mikou K, Rachiq S, Oulidi AJ. Ethnobotanical survey of medicinal and aromatic plants used by the people of Fez in Morocco. *Phytothérapie* 2016;14:35-43.
31. Hammiche V. Treatment of cough based on traditional Kabylean pharmacopoeia. *Phytothérapie* 2015;13:358-72.
32. Eraky MA, El-Fakahany AF, El-Sayed NM, Abou-Ouf EA, Yaseen DI. Effects of *Thymus vulgaris* ethanolic extract on chronic toxoplasmosis in a mouse model. *Parasitol Res* 2016;115:2863-71.
33. Ahmed HM. Ethnopharmacobotanical study on the medicinal plants used by herbalists in Sulaymaniyah province, Kurdistan, Iraq. *J Ethnobiol Ethnomed* 2016;12:1-17.
34. Benarba B, Meddah B, Hamdani H. Cancer incidence in North West Algeria (mascara) 2000-2010: Results from a population-based cancer registry. *Excli J* 2014;13:709-23.
35. Benarba B. Use of medicinal plants by breast cancer patients in Algeria. *Excli J* 2015;14:1164-66.
36. Kim H, Song MJ, Brian H, Choi K. A comparative analysis of ethnomedicinal practices for treating gastrointestinal disorders used by communities living in three national parks (Korea). *J Evid Based Complement Alternat Med* 2014;2014:1-31.
37. Andrade-Cetto A. Ethnobotanical study of the medicinal plants from Tlanchinol, Hidalgo, México. *J Ethnopharmacol* 2009;122:163-71.
38. Gómez-Estrada H, Díaz-Castillo F, Franco-Ospina L, Mercado-Camargo J, Guzmán-Ledezma J, Medina JD, *et al.* Folk medicine in the northern coast of Colombia: An overview. *J Ethnobiol Ethnomed* 2011;7:27.
39. Knecht KT, Nguyen H, Auker AD, Kinder DH. Effects of extracts of lupine seed on blood glucose levels in glucose resistant mice: Antihyperglycemic effects of *Lupinus albus* (white lupine, Egypt) and *Lupinus caudatus* (tailcup lupine, Mesa Verde national park). *J Herb Pharmacother* 2006;6:89-104.
40. Sewani-Rusike CR, Jumbam DN, Chinhoyi LR, Nkeh-Chungag BN. Investigation of hypoglycemic and hypolipidemic effects of an aqueous extract of *Lupinus albus* legume seed in streptozotocin-induced Type I diabetic rats. *Afr J Tradit Complement Altern Med* 2015;12:36-42.
41. Terruzzi I, Senesi P, Magni C, Montesano A, Scarafoni A, Luzi L, *et al.* Insulin-mimetic action of conglutin- γ , a lupin seed protein, in mouse myoblasts. *Nutr Metab Cardiovas Dis* 2011;21:197-205.

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Source of Support: Nil, Conflict of Interest: None declared.