Trop J Nat Prod Res, July 2023; 7(7):3325-3341 ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

Tropical Journal of Natural Product Research

Available online at https://www.tjnpr.org

Original Research Article

Quantitative and Qualitative Ethnobotanical Study of Medicinal Plants used in Oulmes Region, Morocco for the Treatment of Diseases and Infections

Hicham Ikraoun[1]*, Mariem Najem[1], Mohamed El Mderssa[2], Laila Nassiri[1], Jamal Ibijbijen[1]

[1]*Laboratory of Environment and Valorization of Microbial and Plant Resources, Departement of Biology, Faculty of Science, Moulay Ismail Univesity, B.P. 11201, Zitoune Meknes, Morocco.*
[2]*Polydisciplinary Faculty, Soltane Moulay Slimane University, BP: 592, Mghila Beni Mellal, Morroco*

ARTICLE INFO

Article history:
Received 09 April 2023
Revised 01 June 2023
Accepted 26 July 2023
Published online 01 August 2023

ABSTRACT

This work aimed to identify the medicinal plants used in phytotherapy in Oulmes region in Morocco using quantitative tools of ethnobotanical research. For this purpose, comprehensive ethnobotanical surveys were conducted using a semi-structured survey, through the field diary technique and focus groups to collect data from 97 practitioners (herbalists, traditional practitioners, and ordinary citizen) on medicinal plants used for therapeutic purposes in the studied area. As a result, the prevalence of medicinal plant use by men is 62,89% with a female/male sex ratio of 0,59. Seventy-seven medicinal plants belonging to 37 botanical families were recommended by practitioners. More than 58% of the plants are spontaneous and come from forests. Infusion and decoction are the two most commonly used preparation methods for the remedies. Quantitatively, the highest use value was noted for *Origanum compactum* Benth. (Use Value = 0,206). Most of the plants had been used in treating digestive disorders (66%) and cooking preparations (54%). *Lavandula* × *intermedia* Emeric ex Loisel. is noted as the plant with the greatest number of pharmacological properties exploited in the treatments of various ailments such as digestive and respiratory systems ones (Relative Importance = 92,5). In conclusion, we deduced that the Oulmes region has a large reservoir of ethnomedical knowledge and the recipes prescribed are the result of a traditional heritage passed down from one generation to the next and know-how accumulated over the years. Particular attention must be paid to the risks associated with plants used in traditional treatments without scientific validation. It is recommended that this mode of knowledge transmission be maintained with a transfer of evidence-based scientific knowledge.

***Keywords*:** Digestive disorders, ethnobotanical surveys, medicinal plants, phytotherapy, semi-structured questionnaire

Introduction

Throughout the ages, man has been able to rely on nature to provide for his basic needs such as food, shelter, clothing, and also for his medical needs.[1] In this sense, and since antiquity, medicinal plants have been widely used and form the basis of medical treatments. Indeed, until the 18th century, plants were the main therapeutic agents used by man; these plants were used either in a fresh state or in the form of galenic preparations. Towards the end of the 18th century, pharmacists began to extract from medicinal plants some active principles such as heterosides and alkaloids.[2,3] Since then, herbal medicine has been in use, especially in developing countries, where the majority of the population had no or limited access to state-of-the-art healthcare facilities, to treat various ailments.[4]

Morocco, with its distinguished plant diversity resulting from the heterogeneity of its habitats, landscapes, climate and geology, occupies a remarkable place in the Mediterranean region's biodiversity. [5] on the strength of these qualities, the plant gene pool known for its originality is estimated at about 4500 vascular plants species distributed between 41 ecosystems,[6] of which 640 species (16%) and 280 subspecies (32%) are Moroccan endemics.[7] These factors have allowed the country to be among the Mediterranean countries that have a great ancestral know-how in phytotherapy.[8,9] Furthermore, the ancestry of medicinal plants used by the Moroccan population for the treatment of diseases,[8,10] is due to the low cost of plants widely available, but also, in the belief by the miraculous virtues of these plants in the treatment of various diseases, and that these plants are natural products and do not present toxic effects.[11,12]

The Oulmes region in Morocco has a poverty rate ranging from 5,89% to 6,46% for the communes of Oulmés and Ait Ichou respectively. Health facilities and services are limited to three dispensaries for a population scattered in 62 douars,[13] and with fairly modest transport infrastructure. These elements make traditional medicine the first resort for the local population.[14]

Indeed, given that the popular knowledge in traditional pharmacopoeia is currently held by few people who have a high rate of illiteracy,[15] and the great interest of this field in chemical industry and synthetic chemistry[16] that has known in recent decades, there is a renewed interest in the study of medicinal plants and their popular use in various regions of Morocco.[17,18] Nevertheless, studies on this aspect at the level of the Moroccan central plateau remain timid and have been limited to works at the level of the central messeta[19,20] or would only focus on the qualitative aspect .[21]

That is why we tried to achieve an ethnobotanical study, both qualitative and quantitative, in the Central Plateau of Oulmes. The main objective is to increase knowledge about medicinal plants used in the traditional

*Corresponding author. E mail: h.ikraoun@edu.umi.ac.ma
Tel: +212.06.20.30.33.34

Citation: Ikraoun H, Najem M, El Mderssa M, Nassiri L, Ibijbijen J. Quantitative and Qualitative Ethnobotanical Study of Medicinal Plants used in Oulmes Region, Morocco for the Treatment of Diseases and Infections. Trop J Nat Prod Res. 2023; 7(7):3325-3341 http://www.doi.org/10.26538/tjnpr/v7i7.9

Official Journal of Natural Product Research Group, Faculty of Pharmacy, University of Benin, Benin City, Nigeria

pharmacopoeias by the local community actors. This will allow us to deal with various disorders of human systems, as well as to perform a qualitative and quantitative analysis of ethnopharmacological investigations carried out.

Methodology

Presentation of the study area

The study took place in the Oulmes region (Figure 1), the highest locality of the central plateau called the 'Haut Pays'.[22] The work was carried out in the territorial communes of Oulmes, Ait Ichou and Boukachmir. Indeed, the local population is estimated at 20,515 with an average illiteracy rate that amounts to 51,60% .[13]

Climatically, the study area receives annual rainfall ranging from 550 to 750 mm. The region knows a frequent white frost phenomenon that happens especially in winters, according to the Center of Works (CT) and the Arbor station of Oulmes. The average number of frost is 15 to 20 days per year. The climate of the region is Mediterranean with a bioclimate of subhumid type with cool winters.

Determination of the informant sample

The surveys were conducted among herbalists and traditional practitioners of weekly souks in the study area and cooperatives working in the field of harvesting and marketing of aromatic and medicinal plants in the region of Oulmes. For our study, the target Souks are the weekly souks of the region namely: Souk Tlat of Oulmes, Souk Khmiss Tiliouine, Souk Hed Tifoughaline, Souk Sebt of Zquit and Souk Jomâa of Boukachmir (Figure 1) and for the cooperatives, we opted for those whose offices are located in the village center of Oulmes. A total of 97 respondents and survey forms were carefully completed.

Inclusion and exclusion criteria

The inclusion and exclusion criteria used in this study were: plants and informants.

Inclusion criteria: the inclusion criteria for plants were based on the selection of spontaneous or cultivated plants in the studied area, known or used by the respondents. As for the informants, the inclusion criteria were based on their reputation in the field of herbal medicine and herbalism, and on their extended stay within the region.

Exclusion criteria: Plants that did not grow in the study area were excluded. In addition, informants who were not herbal cooperatives, traditional practitioners, or herbalists, who were not native to the study area, who did not live there, or who obtained their products for sale from anywhere, were excluded.

Ethics statement, interview methods and data collection

The ethical approval for the study was granted by the Scientific Research Commission of the Faculty of Sciences of Meknes, the Ethical Research Committee of the Aromatic and Medicinal Plants Pole of the Moulay Ismail University of Meknes and the Provincial Directorate of Water, Forests and combating Desertification of Khemisset in March, 2021 (EA1507/21). The duration of the investigations spread from April to July 2021. Further, at the beginning of each interview, the reasons for the study were explained and we obtained oral consent and agreement from each respondent to participate in the survey. All respondents were informed that the purpose of the research was purely academic and not commercial. They were also informed that their responses would be published anonymously and that they have the right to withdraw their informations at any time during the survey.

Species taxonomic identification

Respondents were interviewed also on the basis of their ability to identify a particular plant by vernacular names. Subsequently, field trips were made to locate the plants listed by the informants with the help of local water and forestry services and some herbalists. The identification of various plant species was carried out with the support of a botanist (Professor Laila NASSIRI). On the taxonomic level, the determination was carried out in the Unit of Environment and Valorization of the Microbial and Plant Resources by using the manuals of determination of the vascular plants "Practical Flora of Morocco".[23,24,25] All names and scientific families have been revised according to the website "Plants of the World online" The reference specimens were deposited in the herbarium of the Unit "Environment and Valorization of Microbial and Plant Resources", Faculty of Sciences, Moulay Ismail University of Meknes, Morocco.

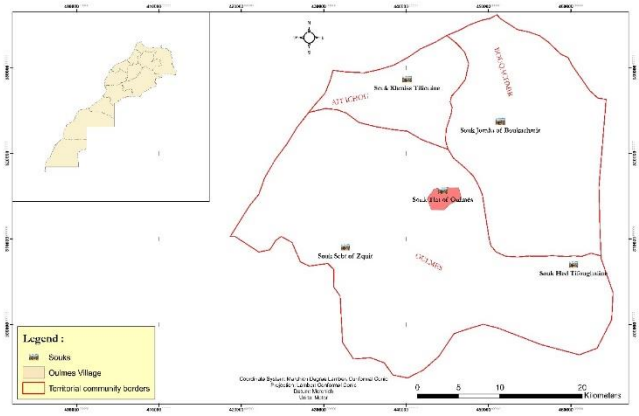

Figure 1: Location of the study area

Data statistical analysis

Data collected and recorded on the survey forms were then typed in and statistically analyzed with the Excel 2016 statistical processing computer software.

For quantitative analysis, the collected data were used to calculate various quantitative indices of it namely: use value (UV), family use values (FUV), relative frequency of citation (RFC), level of fidelity (NF), informant consensus factor (ICF), relative importance (RI) and cultural importance index (CI).[26,27,28,29,30,31,32,33]

Use value (UV): Used to assess respondents' appreciation of locally known medicinal plant species. It was calculated using the following formula [29,31] :

$$UV = \sum_{i=1}^{i=N} (Ui/N)$$

Where Ui = the number of uses mentioned by an informant i and N= the total number of informants surveyed.

Family Use Value (FUV): Family use value (FUV) was used to identify the importance of plant families. It was calculated using the formula shown below [27,34] :

$$\mathbf{FUV = UVs/Ns}$$

Where: UVs = the use value of species belonging to the same family and Ns = the total number of species present in a given family.

Relative frequency of citation (RFC): this index was used to show the local importance of each species [29] :

$$RFC = FC/N$$

Where: FC = the number of informants using a given species and N = the total number of informants interviewed.

Fidelity Index (FI): The fidelity level (FL) is used to determine the most ideal species used to treat a specific condition.[28,31] It is calculated using the following formula:

$$FI\ (\%) = \left(\frac{Np}{N}\right) * 100$$

Where: Np = the number of informants who reported using a given species to treat a diseases and N = the number of informants who mentioned the species for any use.

Informant Consensus Factor (ICF): The informant consensus factor is used to determine the agreement among informants on the use of plants for specific treatment categories.[35] It is calculated using the following formula:

$$ICF = (Nur - Nt)/(Nur - 1)$$

Where: Nur = the number of use reports for a particular ailment category and Nt = the number of herbs mentioned for the treatment of that particular ailment category.

Relative importance (RI): is used to measure the multipurpose use and real value of plants.[30,34,36] The formula used is as follows:

$$RI = (PP + AC) * 100/2$$

Where: PP represents the pharmacological properties, which indicate the relative use reports that were calculated by dividing the number of use reports (UR) attributed to a species by the maximum number of use reports attributed to the most important species (the species with the highest number of use reports), and AC represents the ailments treated, which indicates the relative body systems treated. AC was calculated by dividing the number of body systems treated by a given species by the maximum number of ailment categories treated by the species that were widely used .

Cultural importance index (CI): The cultural importance index (CI) was used to assess the importance of each species.[31,37] It was calculated using the formula developed by Pardo-de-Santayana *et al.*[26] :

$$CI = \sum_{i=1}^{i=NU} URi/N$$

Where URi= the number of use reports of species for different use categories (i, varying from only one use to the total number of uses) and N = the total number of informants interviewed.

Value of the part of the plant (PPV): is calculated using the following formula:

$$PPV = RU\ Plant\ part/RU$$

Where: RU = the number of reported uses for all plant parts and RU plant part = the sum of reported uses per plant part. The part with the highest PPV is the most used by respondents.[32]

Results and Discussion

Participants' demographics characterization

Over the years, plants have always been a source of many treatments for various human diseases and ailments, due to their low cost and effectiveness. Also, In the Oulmes region, the wealth of medicinal plants and the weak economic resources of the local population, have promoted traditional herbal medicine in such a way that it has become widespread. Ethnobotanical surveys conducted among herbalists, the practitioners and cooperatives involved in the field revealed that information on the plants used to combat diseases of various human systems and organs varies from one respondent to another. Medicinal knowledge is still mostly passed from one generation to another over time.[39] Indeed, each individual is the holder of a secret that has been passed on either by their ancestors, during training from holders of traditional know-how, or through knowledge accumulated after many years of experience,[29] hence the importance of having complete information (formal and informal) on the production, use, and management of medicinal plants.[40,41]

A total of 97 respondents were selected for the study through a pre-established survey, face-to-face interviews and focus group discussions, these respondents are divided among 30 herbalists from the weekly souks, 14 cooperators belonging to local cooperatives, 04 of the best-known herbalists from the center of the village of Oulmes, and 49 individuals from the ordinary citizen of the study area.

During the surveys, the prevalence of use of aromatic and medicinal plants by men comes first with a percentage of 62.89% and consequently the sex ratio female/male of 0,59 (Table 1). Indeed, these ethnobotanical surveys conducted among herbalists, the tradipractitioners and cooperatives in the region of Oulmes have shown that the herbal medicine sector is dominated by the male gender, following the example of other works conducted in other regions of Morocco.[30,17,42]

The use of these plants concerns all age groups. People aged 40-49 years have the highest frequency of use of medicinal plants with a percentage of 44,33%. The age groups [50-59], [<30], and [30-39] come next with a percentage of 21,65%, 14,43%, and 12,37%, respectively, while the age group not well represented is the respondents over 60 years old (7,22%) (Table 1). These results show that the distribution of ethno-medical know-how is clearly visible across the different age groups, including those under 30 years of age, which attests to the persistence of natural and traditional treatments and the durability of knowledge transmission from one generation to the next [31].

Regarding the educational level of the respondents, results show that almost all of them are illiterate (76%), while 15,46% have a primary level and 5,15% have a secondary level, and only 3,09% had access to higher education (Table 1), these categories can contribute through their use of information and communication technology to improve and enrich local know-how through self-documentation on the different uses of plants in other regions.

Also, in relation to their origins, the study shows that the majority of respondents are from towns and douars (66%), which proves that the use of medicinal plants by this category of people is customary as in other regions of Morocco[14] and that this activity has become an undeniable source of income, population from cities come third with a use frequency of medicinal plants of 35 % (Table 1).

Biodiversity of inventoried species

In the present study, a total of 77 species belonging to 37 families (36 families (75 species) of Angiosperms and one family (two species) of Gymnosperms), of which Lamiaceae, Apiaceae, Asteraceae and Poaceae are the most represented and whose hold 32 species (42%) of the total number, were mentioned as being used for the treatment of various ailments. Several works[21,43] in the region confirm these results by recognizing that the above-mentioned families have important therapeutic properties. Also, these families are the most represented in Mediterranean countries.[44,45] These identified species with their botanical names, local names, used part, preparation mode, medicinal uses, use value, citation frequency, relative citation frequency and other indices are presented in (Table 2). The most dominant families in terms of maximum number of taxa mentioned were the following: Lamiaceae (18 species), followed by Asteraceae (7 species), and Apiaceae with four species.

Parts of plants used, preparation modes and their availability

Based on a total of 292 reports of use, different parts of plants are used in the preparation of ethno-medical remedies in the Oulmes region. The use of leaves (24,32%) comes in second place after the whole plant (32,19%) with with a PPV index equal to 0,32, and is most likely due to the facility of harvesting without affecting the life cycle of the plant [46]. Another reason for using the aerial parts including leaves, flowers and stems is that this part is the seat of photosynthesis.[47,48] Then comes the fruits (11,99%) and roots (10,96%) as illustrated in fig 2. The part of the plants less used was the seeds (3,77%) and the bark (1,37%).

Different therapeutic practices are used for plant preparation, namely, decoction, infusion, fumigation, powdered preparation, cataplasm, maceration and consumption in a fresh or raw state. The most used preparation modes were infusion (59%), followed by decoction (18%), the use of these practices are based on their easiness and attenuate the toxic effect and allow the extraction of more active principle.[33]

Table 1: Profile of respondents

Variable	Category	Percentage (%)
Sex	**Men**	62.89
	Female	37.11
Age	**<30**	14.43
	30-39	12.37
	40-49	44.33
	50-59	21.65
	>60	7.22
Study level	**Illiterate**	76.29
	Primary	15.46
	Secondary	5.15
	University	3.09
Location	**Cities**	35.05
	Towns	42.27
	Douars	22.68

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

Table 2: List of medicinal plants used in the traditional pharmacopoeia of the Oulmes region

Scientific name	Family	Arabic and/or Amazigh name	Voucher No	Spontaneous (S)/ Cultivated (C)	Location	Used part	Preparation mode	categories of treated ailments and local use	Ui	UV	FC	RFC	UR	CI	PP	AC	RI
Agropyrum repens (L.) P. Beauv.	Poaceae	nejam	FSMO/N008	S	Forest	Root	Decoction	Respiratory/ Urinary	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Allium sativum L.	Amaryllidaceae	touma	FSMO/N014	C	Crop lands	Fruits	Various	Culinary	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Aloysia triphylla Palàu.	Verbenaceae	lewiza	FSMO/N028	C	Crop lands	Leaves / Flowers	Infusion / Distillation	Digestive / Respiratory / Nervous / Culinary	11	0,1134	6	0,06186	4	0,04124	0,8	0,55	67,5
Alpinia officinarum Hance	Zingiberaceae	Khodenjal	FSMO/N001	C	Crop lands	Root / rhizome	Friction/ Infusion	Culinary / Urinary / Genital	5	0,05155	2	0,02062	3	0,03093	0,6	0,25	42,5
Ammi majus L.	Apiaceae	khila	FSMO/N281	S	Forest / Pastures	Whole plant/ Aerial part	Infusion / Decoction/ Grinding	Respiratory / Urinary / Digestive	5	0,05155	4	0,04124	3	0,03093	0,6	0,25	42,5
Ammodaucus leucotrichus Coss.	Apiaceae	kamoun	FSMO/N034	C	Forest	Fruits	Infusion	Culinary	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Anacyclus pyrethrum L.	Asteraceae	Ginass	FSMO/N003	S	Forest	Root	Grinding	Respiratory / Nervous/ Digestive	6	0,06186	2	0,02062	3	0,03093	0,6	0,3	45
Arbutus unedo L.	Ericaceae	arbousier / Sassenou	FSMO/N054	S	Mountain / Forest	Leaves / Fruits	Infusion	Nervous / Digestive / Culinary	10	0,10309	5	0,05155	4	0,04124	0,8	0,5	65
Aristolochia longa L.	Aristolochiaceae	Berztem	FSMO/N101	S	Forest	Root	Decoction/ Drying	Anti-cancer / Respiratory / Urinary / Digestive	6	0,06186	3	0,03093	4	0,04124	0,8	0,3	55

Artemisia absinthium L.	Asteraceae	chiba	FSMO/N050	C	Crop land	Whole plant / Leaves	Infusion / Decoction	Digestive / Nervous / Respiratory	4	0,04124	3	0,03093	4	0,04124	0,8	0,2	50
Artemisia herba-alba Asso.	Asteraceae	chih	FSMO/N069	S / C	Mountain / Forest	Whole plant / Aerial part / Leaves	Infusion / Inhalation	Respiratory / Digestive / Nervous	3	0,03093	3	0,03093	3	0,03093	0,6	0,15	37,5
Atractylis gummifera L.	Asteraceae	addade	FSMO/N057	S	Forest	Root / Fruits	Inhalation/ Fumigation / Friction/ Cataplasme	Nervous / Dermatology/ Respiratory	4	0,04124	2	0,02062	3	0,03093	0,6	0,2	40
Brassica nigra (L.) W.D.J.koch	Brassicaceae	bouhamou	FSMO/N042	S	Forest	Whole plant	Infusion	Respiratory	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Calamintha officinalis Moench.	Lamiaceae	Manta	FSMO/N005	C	Crop land/ Prairie	Whole plant	Infusion	Respiratory / Digestive	7	0,07216	7	0,07216	2	0,02062	0,4	0,35	37,5
Calendula arvensis L.	Asteraceae	jamra	FSMO/N062	C/S	Forest / Mountain	Whole plant	Infusion	Digestive / Nervous/ Genital	8	0,08247	3	0,03093	3	0,03093	0,6	0,4	50
Capsicum frutescens L.	Solanaceae	flifla	FSMO/N007	C	Forest	Fruits	Infusion	Respiratory	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Caralluma europaea (Guss.) Murb.	Euphorbiaceae	daghmouss	FSMO/N032	S	Forest	Aerial part	Cataplasme	Circulatory	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Carum carvi L.	Apiaceae	karwiya	FSMO/N150	S	Forest	Fruits	Infusion / Decoction	Culinary	7	0,07216	7	0,07216	1	0,01031	0,2	0,35	27,5
Ceratonia siliqua L.	Fabaceae	caroubier / Slighwa	FSMO/N164	S	Forest	Whole plant/ Fruits	Infusion/ Decoction	Digestive / Respiratory	9	0,09278	6	0,06186	2	0,02062	0,4	0,45	42,5
Chamaerops humilis L.	Arecaceae	doum / Elghaze	FSMO/N006	S	Mountain / Forest / Pastures	Fruits / Leaves	Infusion / Cataplasme Fresh	Digestive / Respiratory / Genital	9	0,09278	6	0,06186	3	0,03093	0,6	0,45	52,5
Chenopodium ambrosioides L.	Amaranthaceae	mekhinza	FSMO/N200	S/C	Forest	Leaves /	Infusion / Drop / Decoction	Respiratory / Nervous /	5	0,05155	4	0,04124	2	0,02062	0,4	0,25	32,5

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

						Whole plant		Digestive								
Cinnamomum verum J.Presl	Lauraceae	karefa	FSMO/N159	C	Crop land	Ecorce	Infusion / Fumigation	Respiratory	2	0,02062	2	0,02062	1	0,01031	0,2	0,1	15
Cistus ladanifer L.	Cistaceae	touzzalt / ciste	FSMO/N183	S	Mountain / Forest / Crop land	Leaves / Whole plant	Infusion / Decoction/ Drop	Digestive / Respiratory / Nervous	11	0,1134	9	0,09278	3	0,03093	0,6	0,55	57,5
Citrus × *aurantium* L.	Rutaceae	oranger	FSMO/N138	C	Mountain	Flowers	Infusion	Nervous	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Corrigiola telephiifolia Pourr.	Caryophyllaceae	sarghina	FSMO/N049	S	Forest	Root / Root	Decoction/ Infusion / Fresh/ Inhalation	Genital (aphrodisiac)/ Urinary / Nervous / Digestive / Respiratory / Culenaire	7	0,07216	4	0,04124	5	0,05155	1	0,35	67,5
Cynara cardunculus L.	Asteraceae	Heek	FSMO/N004	S	Forest/ Pastures	Aerial part / Seeds / Flowers	Infusion in milk	Culinary /Ddigestive	3	0,03093	3	0,03093	2	0,02062	0,4	0,15	27,5
Datura stramonium L.	Solanaceae	Chdak Jmal	FSMO/N207	S	Forest	Seeds	Fumigation	Respiratory / Nervous	11	0,1134	7	0,07216	2	0,02062	0,4	0,55	47,5
Echinops spinosus L.	Asteraceae	Taskra	FSMO/N156	S	Forest	Root	Infusion/ Decoction	Respiratory / Circulatory	9	0,09278	5	0,05155	3	0,03093	0,6	0,45	52,5
Foeniculum vulgare Mill.	Apiaceae	Bessbass Beldi	FSMO/N055	S	Forest/ Pastures	Root	Decoction/ Grinding	Culinary / Nervous/ Respiratory	4	0,04124	2	0,02062	3	0,03093	0,6	0,2	40
Jasminum officinale L.	Oleaceae	jasmine	FSMO/N121	C	Crop lands	Flowers	Infusion/ Decoction	Digestive / Nervous	4	0,04124	2	0,02062	2	0,02062	0,4	0,2	30
Juniperus oxycedrus L.	Cupressaceae	qatran / Taqqa	FSMO/N009	S	Forest	Root	Maceration / Distillation	Scares away snakes/ Digestive / Nervous /	4	0,04124	3	0,03093	4	0,04124	0,8	0,2	50

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

								Traumatology / Urinary / Dermatology									
Laurus nobilis L.	Lauraceae	warkat sidna mosa	FSMO/N170	S/C	Forest / Mountain / Crop land	Whole plant / Leaves / Flowers	Infusion / Various	Digestive / Culinary / Respiratory	15	0,15464	9	0,09278	3	0,03093	0,6	0,75	67,5
Lavandula dentata L.	Lamiaceae	Helhal / lavande	FSMO/N038	S	Forest / Mountain / Pastures	Whole plant/ Leaves / Flowers	Decoction/ Infusion / Drop	Digestive / Respiratory/ Nervous	5	0,05155	4	0,04124	3	0,03093	0,6	0,25	42,5
Lavandula × *intermedia* Emeric ex Loisel.	Lamiaceae	khezama	FSMO/N149	C	Mountain / Crop land	Whole plant / Leaves / Root / Aerial part / Flowers.	Infusion / Various / Cataplasme / Inhalation / Distillation / Decoction	Dermatology / Digestive / Nervous / Cleaning / Perfumery / Deodorant / Hygiene / Circulatory / Respiratory.	17	0,17526	12	0,12371	5	0,05155	1	0,85	92,5
Lepidium sativum L.	Brassicaceae	hab rechad	FSMO/N162	C	Crop land	Fruits	Infusion/ cataplasme	Respiratory	1	0,01031	1	0,01031	1	0,0102	0,2	0,05	12,5
Linum usitatissimum L.	Linaceae	zriaat ktan	FSMO/N232	C	Prairie	Seeds	Infusion	Respiratory	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Marrubium echinatum Ball	Lamiaceae	mriouta	FSMO/N044	S	Forest	Whole plant	Infusion / Decoction	Respiratory / Nervous	3	0,03093	3	0,03093	2	0,02062	0,4	0,15	27,5
Marrubium vulgare L.	Lamiaceae	meriwta	FSMO/N129	S	Mountain / Forest	Whole plant	Various	Circulatiore/ Nervous	9	0,09278	6	0,06186	2	0,02062	0,4	0,45	42,5
Matricaria chamomilla L.	Asteraceae	babounj	FSMO/N119	C/S	Crop land /	Whole plant /	Infusion / Decoction	Digestive / Nervous	6	0,06186	5	0,05155	2	0,02062	0,4	0,3	35

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

					Forest / Mountain	Flowers / Root										
Mentha × *piperita* L.	Lamiaceae	menth rosier / Neênaâ abdi	FSMO/N237	C	Crop land	Aerial part / Leaves	Infusion / Grinding	Respiratory / Digestive / Culinary	4	0,04124	5	0,05155	3	0,03093	0,6	0,2	40
Mentha pulegium L.	Lamiaceae	Fléau	FSMO/N011	C / S	Crop lands/ Mountain/ forest	Aerial part/ Leaves	Distillation	Respiratory / Digestive / Culinary	9	0,09278	6	0,06186	3	0,03093	0,6	0,45	52,5
Mentha suaveolens Ehrt.	Lamiaceae	mersita	FSMO/N137	S/C	Forest / Mountain / Crop land	Leaves / Whole plant / Aerial part	Fresh/ Decoction/ Infusion	Culinary / Nervous / Urinary / Digetsif / Respiratory	12	0,12371	6	0,06186	5	0,05155	1	0,6	80
Mercurialis annua L.	Euphorbiaceae	hriga	FSMO/N276	S	Forest	Whole plant	Infusion	Respiratory	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Myrtus communis L.	Myrtaceae	raihan	FSMO/N240	S/C	Mountain/ Forest/ Crop land	Leaves / Flowers/ Fruits	Decoction/ Infusion / Various	Culinary / Digestive / Respiratory / Nervous	8	0,08247	6	0,06186	4	0,04124	0,8	0,4	60
Nerium oleander L.	Apocynaceae	defla	FSMO/N147	S	Mountain/ Forest	Root / Whole plant	Infusion / Decoction	Respiratory	2	0,02062	2	0,02062	1	0,01031	0,2	0,1	15
Nigella sativa L.	Renonculaceae	habat baraka / Sanouj	FSMO/N246	C	Crop lands	Whole plant / Leaves	Infusion / Decoction	Digestive / Urinary / Nervous / Respiratory / Circulatory	8	0,08247	4	0,04124	5	0,05155	1	0,4	70
Ocimum basilicum L.	Lamiaceae	Hbak	FSMO/N078	C	Crop land	Aerial part	Infusion	Respiratory / Culinary / Digestive	13	0,13402	5	0,05155	3	0,03093	0,6	0,65	62,5
Olea europea L. var. sylvestris (Hoffmanns	Oleaceae	zebbouj	FSMO/N286	S/C	Forest / Crop land	Seeds / fruits	Infusion / Various	Circulatory / Nervous/ Digestive /	7	0,07216	2	0,02062	4	0,04124	0,8	0,35	57,5

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

&Link) Negodi.								Dermatology									
Opuntia ficus indica (L.) Mill.	Cactaceae	zaaboul	FSMO/N172	C/S	Crop lands/ forest	Flowers/ fruits	Infusion/ Fresh	Respiratory / Digestive	3	0,03093	2	0,02062	2	0,02062	0,4	0,15	27,5
Origanum compactum Benth.	Lamiaceae	zaatar	FSMO/N269	S/C	Mountain / Forest/ Crop land	Whole plant / Leaves / Aerial part	Infusion / Decoction/ Distillation / Drying	Respiratory / Culinary / Digestive	20	0,20619	14	0,14433	3	0,03093	0,6	1	80
Origanum majorana L.	Lamiaceae	maredadoch	FSMO/N113	S	Forest	Leaves / fruits	infusion	Digestive / Respiraoire	2	0,02062	2	0,02062	2	0,02062	0,4	0,1	25
Origanum vulgare L.	Lamiaceae	Izoukeni / Izri	FSMO/N215	S	Forest/ Pastures	Aerial part/ Leaves	Infusion	Digestive / Nervous	2	0,02062	3	0,03093	2	0,02062	0,4	0,1	25
Panicum miliaceum L.	Poaceae	ilan	FSMO/N185	C	Forest / Prairie	Fruits	Infusion	Respiratory	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Papaver rhoeas L.	Papaveraceae	belaaman	FSMO/N094	S	Forest / Prairie	Fruits	Infusion / Decoction	Respiratory / Culinary	3	0,03093	3	0,03093	2	0,02062	0,4	0,15	27,5
Papaver somniferum L.	Papaveraceae	kherchacha	FSMO/N193	S	Forest Prairies	Fruits	Infusion	Respiratory	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Pelargonium cordifolium (Cav.) Curtis	Geraniaceae	âatarecha	FSMO/N016	C	Crop lands	Whole plant	Infusion	Culinary	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Pistacia atlantica Desf.	Anacardiaceae	Btam	FSMO/N076	S	Forest	Fruits / Leaves / Ecorce	Grinding / Decoction	Respiratory / Digestive / Culinary	7	0,07216	4	0,04124	3	0,03093	0,6	0,35	47,5
Populus alba L.	Salicaceae	safsaf	FSMO/N177	S	Forest	Leaves	Decoction	Respiratory	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Prasium majus L.	Lamiaceae	Naánaa l'abbúch	FSMO/N233	C	Forest / Prairie / Crop land	Fruits / Aerial part / Leaves	Grinding / Infusion / Decoction	Digestive / Urinary / Culinary / Nervous	4	0,04124	2	0,02062	3	0,03093	0,6	0,2	40
Quercus ilex L.	Fagaceae	kerrouch	FSMO/N142	C	Forest	Whole plant / Ecorce	Infusion / Decoction	Digestive	3	0,03093	3	0,03093	1	0,01031	0,2	0,15	17,5

Rosa sempervirens L.	Rosaceae	ward	FSMO/N189	S/C	Mountain / Forest / Crop land	Whole plant	Infusion	Digestive / Dermatology	7	0,07216	5	0,05155	2	0,02062	0,4	0,35	37,5
Rosmarinus officinalis L.	Lamiaceae	azir	FSMO/N221	S/C	Mountain / Crop land / Forest	Leaves / Flowers	Infusion / Distillation / Decoction/ Drop	Respiratory / Digestive / Urinary / Nervous / Dermatology / Culinary	11	0,1134	7	0,07216	5	0,05155	1	0,55	77,5
Rubia tinctorum L.	Rubiaceae	rbibia	FSMO/N063	S	Mountain	Whole plant	Decoction	Respiraoire	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Ruta chalepensis L.	Rutaceae	fijel	FSMO/N250	S	Forest	Whole plant	Decoction/ Infusion	Digestive	2	0,02062	2	0,02062	1	0,01031	0,2	0,1	15
Salvadora persica L.	Salvadoraceae	swak	FSMO/N179	S	Pastures	Root	Drying	Gum treatment	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Salvia officinalis L.	Lamiaceae	salmiya	FSMO/N116	S/C	Forest	Whole plant / fruits	Infusion	Nervous / Digestive / Respiratory	4	0,04124	3	0,03093	3	0,03093	0,6	0,2	40
Sorghum vulgare Pers.	Poaceae	Douchen	FSMO/N017	C	Crop lands	Whole plant/ Leaves	Infusion	Respiratory	3	0,03093	3	0,03093	1	0,01031	0,2	0,15	17,5
Spinacia oleracea L.	Amaranthaceae	sabanikh	FSMO/N181	C	Crop land	Whole plant	Infusion	Culinary	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Syzygium aromaticum L.	Myrtaceae	kranfel	FSMO/N153	S	Mountain / Forest	Leaves / Whole plant	Infusion	Nervous / Respiratory	2	0,02062	2	0,02062	2	0,02062	0,4	0,1	25
Tetraclinis articulata (Vahl.) Masters.	Cupressaceae	aâraar	FSMO/N091	S	Forest / Mountain	Leaves / Aerial part	Decoction/ Infusion	Nervous/ Respiratory / Dermatology / Digestive	27	0,27835	4	0,04124	5	0,05155	0,8	0,3	55
Thymus maroccanus Ball	Lamiaceae	zaitra	FSMO/N175	S/C	Forest / Crop land / Pastures/	Whole plant/ Leaves /	Infusion/ Various	Respiratory / Culinary / Digestive / Nervous	11	0,1134	6	0,06186	5	0,05155	1	0,55	77,5

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

					Mountain	Aerial part										
Thymus Zygis L.	Lamiaceae	Zaâtre beldi	FSMO/N215	S	Forest	Aerial part/ Leaves	Infusion	Culinary / Digetsif / Nervous	5	0,05155	2	0,02062	3	0,03093	0,6	0,25	42,5
Trigonella foenumgraecum L.	Fabaceae	halba	FSMO/N187	C	Mountain	Whole plant / Seeds	Infusion / Infusion	Digestive / Respiraoire	2	0,02062	2	0,02062	2	0,02062	0,4	0,1	25
Urginea scilla Steinh.	Asparagaceae	Bssila	FSMO/N020	S	Forest	Whole plant / Root	Decoction/ infusion	Urinary / Genital / Circulatory / Respiratory	5	0,05155	3	0,03093	4	0,04124	0,8	0,25	52,5
Vitex agnus-castus L.	Lamiaceae	kharwaa	FSMO/N191	S	Forest	Leaves	Infusion	Culinary	2	0,02062	2	0,02062	1	0,01031	0,2	0,1	15
Zingiber officinale Roscoe	Zingiberaceae	zanjabil	FSMO/N133	S	Forest / Prairie	Root	Infusion	Respiratory	1	0,01031	1	0,01031	1	0,01031	0,2	0,05	12,5
Ziziphus lotus (L.) Lam..	Rhamnaceae	Sedr	FSMO/N024	S	Forest	Leaves / fruits	Decoction/ infusion	Urinary / Hair/ Genital / Dermatology	4	0,04124	2	0,02062	2	0,02062	0,4	0,2	30

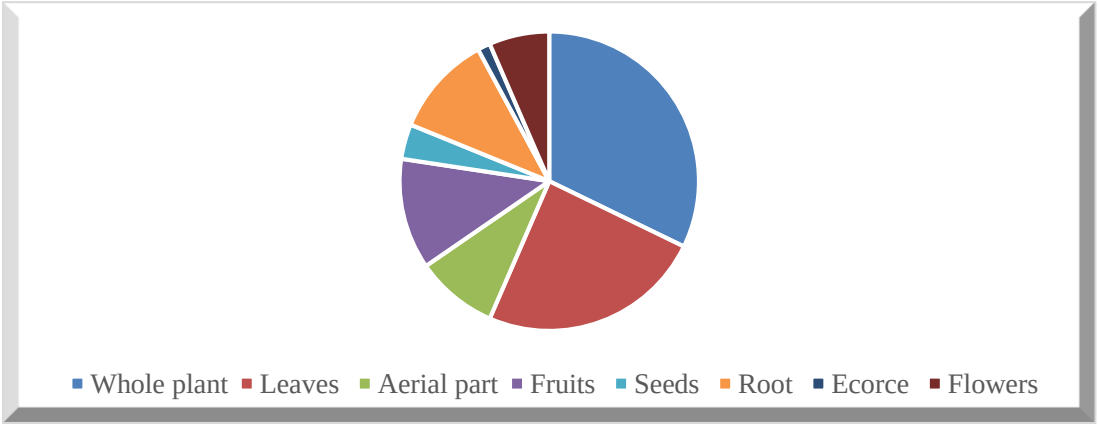

Figure 2. Used parts of plants in the treatment of different ailments.

Other practices come next such as grinding (3,29%) and fumigation (3%). Drying, rubbing and maceration came last (0,98%) (Figure 3).
The collection of plants, according to the statements of the respondents, was generally operated from various types of habitats, and come mainly from the spontaneous state of the forests and mountains bordering it (more than 60%) (forests (58,90%), mountains (16,44%)) and cultivated land (16,10%) come in third place, finally we found the pastures (8,56%) as shown in Figure 4. These results shows the richness of the area in spontaneous medicinal plants. This use of plants from the area for medical treatment exposes these resources to the threat of overexploitation, especially for the endemic species of the area, notably *Thymus maroccanus* Ball. Also, such action endangers the situation of other rare species namely: *Pistacia atlantica* Desf., *Aristolochia longa* L., *Cynara cardunculus* L. *Tetraclinis articulata* (Vahl) Masters., *Juniperus oxycedrus* L., *Arbutus unedo* L. *Ceratonia siliqua* L., *Marrubium echinatum* Ball, *Origanum compactum* Benth, *Urginea scilla* Steinh, *Rosa sempervirens* L. and very rare or even threatened in occurrence *Calendula arvensis* L.[49] Growing plants for medicinal purposes is starting to develop and comes in second place with a rate of 28% compared with those coming from spontaneous state. These data are consistent with those found in 2006 by a U.S. Agency for International Development study on national aromatic and medicinal plants.[6]

Quantitative Data analysis
It is the first time that a study on the quantitative data of the medicinal flora of the region of Oulmes is carried out and this in a perspective of making the related results comparable and reproducible, for that we resorted to calculations of index on the relative frequency of quotation, of the value of use, of the index of fidelity, of the factor of consensus of the informants, of the relative importance and of the value of the cultural importance.

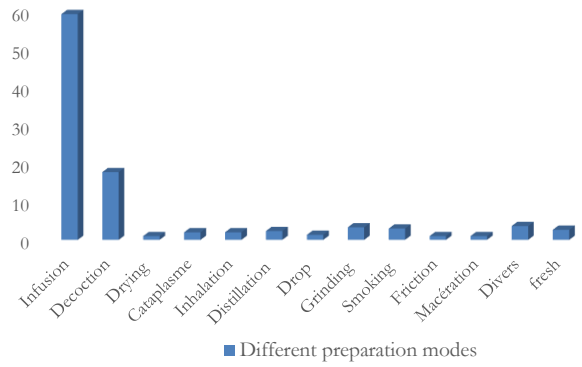

Figure 3: Plant preparation methods for a variety of ailments.

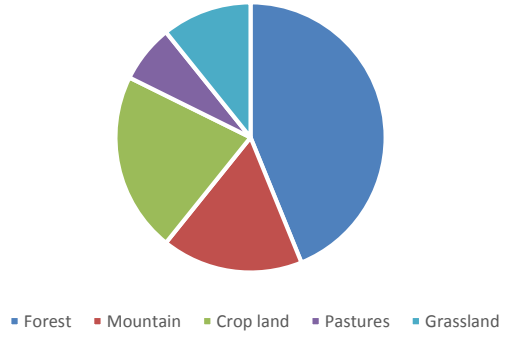

Figure 4: Origins of the harvested plants used in the treatment of the different ailments

Usage values of species and families
In order to evaluate the relative importance of the medicinal plants used by the community of the Oulmes region, the usage value has been retained. Calculating that index of the species allows us to establish a link between each species and the uses assigned to it.[33] High use values reflect the importance given to species in connection with their therapeutic virtues. The UV of the mentioned plant species varied from 0,010 to 0,27835. The highest UV was found for *Tetraclinis articulata* (Vahl.) Masters (UV= 0,27835) while the lowest was for the plants *Ruta chalepensis* L. , *Citrus* × *aurantium* L., *Pelargonium cordifolium* (Cav.) Curtis, *Spinacia oleracea* L., *Allium sativum L.*, *Ammodaucus lencotrichus Coss. & Durieu*, *Mercurialis annua L.*, *Lepiduim sativum* L., *Brassica nigra* (L.) W. D. J. koch, *Papaver somniferum* L., *Agropyrum repens* (L.) P. Beauv., *Panicum miliaceum* L., *Zingiber officinale* Roscoe, *Capsicum frutescens* L., *Populus alba* L., *Caralluma europaea* (Guss.) Murb., *Salvadora persica* L. with UV values of the order of 0,010. This low value is probably due to a lack of knowledge of these plants by the respondents and their medicinal properties. Other important plant species with high use value were *Lavandula* × *intermedia* Emeric ex Loisel. (0,175) and *Laurus nobilis* L. (0,155) as illustrated in the Table 2. In addition, species with high UV signifying their uses in the treatment of various ailments such as *Tetraclinis articulata* (Vahl.) Masters used in the treatment of nervous, respiratory, dermatology, digestive ailments. Indeed, these results are consistent with Khatib *et al.* [50] work which found that stomach pain, respiratory and intestinal infections, diabetes and hypertension were the most frequently treated diseases by Tetraclinis tree. in this sense, the work of Rached *et al.* [51] evaluated the *in vitro* anti-inflammatory potential of the aqueous extract of *T. articulata* leaves on lipopolysaccharides (LPS) - induced nitric oxide (NO) production by murine macrophages. They found that the extract and its organic fractions, ethyl acetate and butanol, significantly reduced LPS-induced NO production and the butanol fraction significantly reduced NO production. They linked the significant anti-inflammatory effect with the richness of the plant extract in flavonoids, particularly catechin, epicatechin and myricetin-3-O-rhamnoside. Aqueous extract in vitro test on the formation and inhibition of calcium oxalate monohydrate using polarized light microscopy, show that the extract prevented urinary stones growth, with the highest inhibitory effects.[50] In addition, several in vivo studies proved that the plant's essential oil (EO) could be a natural neuroprotective agent against the effects of Aβ1-42 induced neurotoxicity.[52,53] Phytochemicals identified, by in vitro methods, from the crude aqueous extract of *T. articulata* and its fractions, namely, ethyl acetate and butanol fractions, have been reported to have excellent efficacy as antioxidants.[51,54-57]
Regarding the use value of the families, the two families with the highest UVF are: Verbenaceae and Cistaceae (UVF = 0,113). The families with the lowest use value are Rubiaceae, Ericaceae, Amaranthaceae, Geraniaceae, Amaryllidaceae, Brassicaceae, Euphorbiaceae, Linaceae, Salicaceae, Salvadoraceae (UVF=0,010) (Table 3). Our results confirm that the important families are not the most represented in number of species, but rather, the importance and use value of the species belonging to these families in the treatment of various diseases.[31,33]

Relative Frequency of Citation and usage ratio:
The Citation relative frequency (RFC) was used to record the highest therapeutic medicinal flora. The RFC calculation revealed that some species are more recommended than others, probably because they are well known to the respondents for their frequent use in the treatment of various diseases.[58] The RFC values were ranged from 14,433% to 1,031% for the different curative uses of medicinal plants (Table 2). The most cited species by the informants was *Origanum compactum* Benth. (RFC=0,144), followed by *Lavandula* × *intermedia* Emeric ex Loisel. (RFC=0,123) with medicinal indications for the treatment of digestive, respiratory and culinary systems. In fact, the antibacterial activity of organic extracts of the flowering tops of *Origanum compactum* Benth was evaluated against four bacterial strains undertaken by Bouyahya *et al.*,[59] nammely, *Staphylococcus aureus*, *Listeria monocytogenes*, *Escherichia coli* K_{12} and *Pseudomonas aeruginosa*. The result showed that the antibacterial agents are more active against Gram+ bacteria

(*Staphylococcus aureus* and *Listeria monocytogenes*) than against Gram- bacteria (*Escherichia coli* K_{12} and *Pseudomonas aeruginosa*). As well, the antibacterial properties of *Origanum compactum* Benth essential oils and extracts against pathogenic bacteria were reported and indicated antibacterial effect of Oregano flowers, leaves and stems essential oil against five of pathogenic bacteria of *salmonella* sp isolated from food borne.[59] Also, the antioxidant activity of organic extracts of *Origanum compactum* Benth were found to be active and remarkable in the scavenging of DPPH radical.[59,60] Species that are lowly cited are *Spinacia oleracea* L., *Citrus* × *aurantium* L., *Pelargonium cordifolium* (Cav.) Curtis, *Allium sativum* L., *Ammodaucus leucotrichus* Coss., *Lepidium sativum* L., *Brassica nigra* (L.) W.D.J.koch, *Caralluma europaea* Guss. Murb., *Linum usitatissimum* L., *Papaver somniferum* L., *Agropyrum repens* L. P.Beauv., *Panicum miliaceum* L., *Zingiber officinale* Roscoe, *Capsicum frutescens* L., *Populus alba* L. *and Salvadora persica* L. with a RFC = 0,010.

In our study, the value of the use ratio varied from 1 to 14. *Origanum compactum* Benth. followed by *Lavandula* × *intermedia* Emeric ex Loisel were the most used plant species.

Fidelity level

The fidelity level "FL" calculation is a very useful parameter to determine the most effective species to treat a disease category [34]. In the present study, the fidelity level ranged from 8,33 to 100%. This is most likely due to the important number of active principles contained in these plants. The most commonly used plant species in the study area with 100% fidelity levels to treat respiratory tract diseases were *Agropyrum repens* (L.) P. Beauv., *Anacyclus pyrethrum* L., *Brassica nigra* L. W. D. J. koch, *Capsicum frutescens* L., *Cinnamomum verum* J. Presl., *Datura stramonium* L., *Echinops spinosus* L., *Lepiduim sativum* L., *Linum usitatissimum* L., *Mercurialis annua* L., *Nerium oleander* L., *Ocimum basilicum* L., *Opuntia ficus indica* L. Mill., *Papaver somniferum* L., *Populus alba* L., *Ruta chalepensis* L. , *Sorghum vulgare* Pers. *and Zingiber officinale* Roscoe. These results are consistent with those of El Hilah *et al.*[21] In this context, bibliographic research has shown that among the plants used by the respondents in the treatment of respiratory diseases in our case: *Ziziphus lotus* (L.) Lam, *Foeniculum vulgare* Mill. and *Nerium oleander* L. have proven their antibacterial effects on the strains of bacteria most commonly known as pathogens responsible for pneumonia namely *Staphylococcus aureus*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa.*[61,62,63,64] Also, studies conducted on *Lepidium sativum* L. recommended by the practitioners of traditional medicine interviewed to treat cough and bronchitis have confirmed this popular use.[65] Moreover, it has been highlighted that thyme, praised for the treatment of digestive diseases, has proven antispasmodic activity as early as 1960.[66] The mechanism was found to be antagonistic non-competitive (contractions induced by carbachol, histamine and BaCl2). The inhibitory effect may be explained by inhibition of Ca^{2+} entry into smooth muscle through voltage-stimulated channels and/or blocking Ca^{2+} release into smooth muscle and/or blocking intracellular bound Ca^{2+} release.[67-70] The species with the highest FL values (FL=100%) for the treatment of digestive tract diseases are *Ceratonia siliqua* L., *Anacyclus pyrethrum* L., *Calendula arvensis* L., *Jasminum officinale* L., *Olea europea L. var. sylvestris* (Hoffmanns & Link) Negodi, *Prasium majus* L., *Quercus ilex* L., *Ruta chalepensis* L. *and Thymus Zygis* L.. The most declared plants for their virtues in the treatment of other devices are summarized in the Table 4.

Informant consensus factor

Respondents used medicinal plants in the treatment of several health disorders. The Informant Consensus Factor (ICF) reflects the consistency of training provided by different informants on the species used to treat a disease category.[34] Thus, the plants with high values in ICF deserve to be diagnosed in depth and through scientific tools to qualify their virtues and active principles responsible for intervening in the treatment of the ailments to which they are recommended. The present study illustrates that ICF values range from 0,20 to 0,66. The digestive system ailment holds the highest value (0,66), followed by 0,54 for culinary uses. The disease with the lowest FCI values were genital (0,44) and urinary (0,20) (Table 5). The low ICF values for the treatment of urinary diseases can be explained by the lack of communication between practitioners of traditional medicine, by the wealth of active plants available to treat this type of diseases [31]

Table 3: Utilization values of plants involved in pharmacopoeia in the Oulmes area

Family	Uvs	Ns	FUV
Amaranthaceae	0,062	2	0,031
Amaryllidaceae	0,010	1	0,010
Anacardiaceae	0,072	1	0,072
Apiaceae	0,175	4	0,044
Apocynaceae	0,021	1	0,021
Arécaceae	0,093	1	0,093
Aristolochiaceae	0,062	1	0,062
Asparagaceae	0,052	1	0,052
Asteraceae	0,041	1	0,041
Asteraceae	0,402	7	0,057
Brassicaceae	0,021	2	0,010
Cactaceae	0,031	1	0,031
Caryophyllaceae	0,072	1	0,072
Cistaceae	0,113	1	0,113
Cupressaceae	0,103	2	0,052
Ericaceae	0,103	1	0,103
Euphorbiaceae	0,021	2	0,010
Fabaceae	0,113	2	0,057
Fagaceae	0,031	1	0,031
Géraniaceae	0,010	1	0,010
Lamiaceae	1,443	18	0,080
Lauracées	0,155	2	0,088
Linaceae	0,010	1	0,010
Myrtaceae	0,103	2	0,052
Oleaceae	0,113	2	0,057
Papaveraceae	0,041	2	0,021
Poaceae	0,052	3	0,017
Renonculaceae	0,082	1	0,082
Rhamnaceae	0,041	1	0,041
Rosaceae	0,072	1	0,072
Rubiaceae	0,010	1	0,010
Rutaceae	0,031	2	0,015
Salicaceae	0,010	1	0,010
Salvadoraceae	0,010	1	0,010
Solanaceae	0,124	2	0,062
Verbenaceae	0,113	1	0,113
Zingiberaceae	0,062	2	0,031

Table 4: Fidelity level of plants used in pharmacopoeia in the Oulmes area.

Use category	Species fidelity level
Respiratory disorders	*Echinops spinosus* L., *Anacyclus pyrethrum* L., *Datura stramonium* L., *Ocimum basilicum* L., *Opuntia ficus indica* (L.) Mill., *Agropyrum repens* (L.) P. Beauv., *Brassica nigra* L. W. D. J. koch, *Capsicum frutescens* L., *Cinnamomum verum* J. Presl., *Lepiduim sativum* L., *Linum usitatissimum* L., *Mercurialis annua* L., *Nerium oleander* L., *Papaver somniferum* L., *Populus alba* L., *Ruta chalepensis* L., *Sorghum vulgare* Pers., *Zingiber officinale* Roscoe. (100%). *Calamintha officinalis* Moench. (86%), *Pistacia atlantica* Desf. (75%), *Mentha pelugium* L., *Cistus ladanifer* L., *Aristolochia longa* L., *Marrubium echinatum* Ball., *Papaver rhoeas* L.(67%), *Rosmarinus officinalis* L. (58%).
Digestive disorders	*Anacyclus pyrethrum* L., *Ceratonia siliqua* L., *Calendula arvensis* L., *Olea europea subsp. europaea var. sylvestris* Lehr. , *Jasminum officinale* L., *Thymus Zygis* L., *Prasium majus* L., *Quercus ilex L., Ruta chalepensis* L. (100%), *Laurus nobilis* L. (89%) , *Origanum compactum* Benth. (86%), *Aloysia triphylla* Palàu. (83%) , *Arbutus unedo* L. (80%), *Pistacia atlantica* Desf., *Chenopodium ambrosioides* L., *Nigella sativa* L. (75%), *Chamaerops humilis* L., *Mentha suaveolens* Ehrt., *Myrtus communis* L. (67%), *Ocimum basilicum* L., *Rosa sempervirens* L. (60%), *Lavandula × intermedia* Emeric ex Loisel. (58%).
Cardiovascular disorders	*Olea europea subsp. europaea var. sylvestris* Lehr., *Marrubium vulgare* L., *Caralluma europaea* Guss. Murb. (100%), *Urginea scilla* Steinh.(67%).
Genital disorders	*Alpinia officinarum* Hance, *Ziziphus lotus* L. Lam. (100%), *Calendula arvensis* L. (67%).
Nervous disorders	*Calendula arvensis* L., *Olea europea subsp. europaea var. sylvestris* Lehr., *Anacyclus pyrethrum* L., *Jasminum officinale* L., *Matricaria chamomilla* L., *Atractylis gummifera* L., *Citrus × aurantium* L., *Salvadora persica* L. (100%), *Mentha suaveolens* Ehrt., *Salvia officinalis* L.(67%), *Arbutus unedo* L .(60%), *Datura stramonium* L .(57%).
Urinary disorders	*Alpinia officinarum* Hance (100%), *Aristolochia longa* L.(67%),
Dermal disorders	*Rosa sempervirens L.* (80%).
Culinary	*Thymus Zygis* L., *Foeniculum vulgare* Mill., *Ziziphus lotus* (L.) Lam., *Ocimum basilicum* L., *Allium sativum* L., *Ammodaucus leucotrichus* Coss., *Carum carvi* L., *Pelargonium cordifolium* Cav. Curtis., *Spinacia oleracea* L., *Vitex agnus-castus* L .(100%), *Laurus Nobilis* L., *Cynara cardunculus* L. (67%).

Table 5: Informant Consensus Factor (ICF) by ailment categories in the study area

Ailment Category	Nur	Nt	ICF
Respiratory disorders	110	52	0,53
Digestive disorders	120	42	0,66
Cardiovascular disorders	17	9	0,50
Genital disorders	10	6	0,44
Nervous disorders	63	33	0,48
Urinary disorders	11	9	0,20
Dermal disorders	12	7	0,45
Culinary	55	26	0,54

Relative Importance Index

Regarding the relative importance index, the plant with the most versatile use is attributed to the plant *Lavandula× intermedia* Emeric ex Loisel. (RI = 92,5), as it has the greatest number of pharmacological properties exploited in the treatment of the digestive, nervous, respiratory, skin, cold care, in perfumery, hygiene and the manufacture of deodorant products. In second place comes *Origanum compactum* Benth. and *Mentha suaveolens* Ehrt. (RI=80) (Table 2).

Cultural importance index (CI)

This index would be more appropriate to measure the variation of knowledge between different communities.[38] It is also used to assess the importance of plant in a given use category. The present quantitative study showed that the value of the CI varies between 0,010 and 0,052. The plants that show up as having the highest CI are the following*:* *Thymus maroccanus* Ball, *Mentha suaveolens* Ehrt., *Nigella sativa* L., *Lavandula × intermedia* Emeric ex Loisel., *Rosmarinus officinalis* L., *Corrigiola telephiifolia* Pourr. and *Tetraclinis articulata* (Vahl.)

Masters. The plant CI values of the other plants are summarized in Table 2.

Conclusion

The present work constitutes represents a contribution to a quantitative ethnobotanical study of medicinal plants used in the traditional pharmacopoeia in the Oulmes region. It has allowed us to list 77 spontaneous or cultivated plants in the 'high country' of the central plateau that are used and/or recommended by the herbalists of the weekly souks, the tradipractitioners and the local cooperatives in the preparation of remedies for various ailments.

Thus, the results of the study show that the region of Oulmes has a large reservoir of ethno-medical knowledge, especially regarding the use of medicinal plants in primary health care, which is confirmed by the calculation of different indexes such as UV, RFC, FUV, FL, IR, CI, and ICF. The illiteracy rate of traditional medicine users is quite high, exceeding 76%. Furthermore, all age groups use this kind of medication.

Thus, there is a need to keep the transmission flow of this valuable traditional knowledge between generations, but also, more in-depth study projects, especially chemical and pharmacological, are recommended to understand more precisely the use of these plants by traditional medicine practitioners for traditional herbal medication. Furthermore, nowadays, and with the place that the green jobs occupy, the sensitization of the population and the research to other sources of incomes such as the tradidtional pharmacopoeia is of setting

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them

Acknowledgements

The authors would like to express their gratitude to the local forestry personnel for their help throughout the surveys, and also to the cooperatives that work in the field of aromatic and medicinal plants in the region of Oulmes and the traditional practitioners who responded favorably to our questionnaires.

References

1. Gurib-Fakim A. Medicinal plants: traditions of yesterday and drugs of tomorrow. Molecular asp of Med. 2006 ;27(1): 1-93.
2. Rahman I U, Afzal A, Iqbal Z, Ijaz F, Ali N, Shah M, Bussmann R.W. Historical perspectives of Ethnobotany. Clinics in Dermato. 2019; 37(4): 382-388.
3. Verain A. Medicinal plants: evolution of their use and legislation. In: Ethnopharmacology, sources, methods, objectives: proceedings of the 1st European Colloquium of Ethnopharmacology, Metz, Centre international of congres, 23-25 mars 1990. IRD Editions. 1991. 50 p.
4. Kankara S. S., Tukur K., Bello A., Lawal U., Bindawa, K. A. Medicinal Plants used for Complementary and Alternative Cancer Therapy in Katsina State, Northwestern Nigeria: doi. org/10.26538/tjnpr/v4i9. 21. Tropl Jof Nat Prod Resh. 2020 4(9), 621-629. doi.org/10.26538/tjnpr/v4i9.21.
5. Jamaleddine M, El Oualidi J, Taleb M. S, Alaoui-Faris E. Inventory and state of conservation of aromatic and medicinal plants (MAP) in Morocco. Phytothérapie. 2017; 15(3): 114-122.
6. USAID (United States Agency for International Development), Morocco, Integrated agriculture and agribusiness: aromatic and medicinal plants project. 2006; 11-16.
7. Fennane M, Ibn Tattou M. Statistics and comments on the current inventory of the vascular flora of Morocco. Bulletin of the Scientific Institute, Rabat, Life Sciences section. 2012; 34 (1): 1-9.
8. Bellakhdar J, Claisse R, Fleurentin J, Younos C.v. Repertory of standard herbal drugs in the Moroccan pharmacopoea. J of Ethnopharma. 1991; 35(2): 123-143.
9. Benkhnigue O, Zidane L, Fadli M, Elyacoubi H, Rochdi A, Douira A. Ethnobotanical study of medicinal plants in the region of Mechraâ Bel Ksiri (Gharb Region of Morocco). Acta bot barcino; 2010. 191-216 p.
10. Abouri M, El Mousadik A, Msanda F. An ethnobotanical survey of medicinal plants used in the Tata Province, Morocco. Int J of Med Plants Res. 2012; 1(7): 99–123.
11. Zekkour M. The risks of phytotherapy, monographs of the most common toxic plants in Morocco, Ph.D. thesis, Faculty of Medicine and Pharmacy, Rabat, Morocco. 2008.
12. Chebaibi M, Bousta D, Iken I, Hoummani H, Ech-Choayeby A, Najdi A, Achour S. Ethnopharmacological survey of medicinal plants used in traditional treatment of kidney diseases in fez-meknes region, Morocco. Phytotherapie. 2020; 18(2): 99–114.
13. High Commission For Planning Morocco. General Census of Population and Housing. 2014.
14. Achour S, Chebaibi M, Essabouni H, Bourhia M, Ouahmane L, Mohammad Salamatullah A , Aboul-Soud M.A.M, Giesy J P. Ethnobotanical Study of Medicinal Plants Used as Therapeutic Agents to Manage Diseases of Humans. Evide-Bas Compl and Altere Med 2022. 2022; 1-8.
15. Hseini S, Kahouadji A. Ethnobotanical study of the medicinal flora in the region of Rabat (Western Morocco). Lazaroa, 2007; 28: 79-93.
16. El-Hadri Y. Contribution to the ethnobotanical study of medicinal plants used in the region of Beni Mellal-Khenifra. PhD thesis, Faculty of medicine and pharmacy of Rabat. Mohammed V University, Morocco. 2019. 243 p.
17. Bachiri L, Labazi N, Daoudi A, Ibijbijen J, Nassiri L, Echchegadda G., Mokhtari F. Ethnobotanical study of some spontaneous Moroccan lavenders. Int. J. Biol. Chem. Sci, 2015; 9(3) : 1308–1318.
18. Slimani I, Najem M, Belaidi R, Bachiri L, Bouiamrine E.H, Nassiri, L, Ibijbijen JEthnobotanical study of medicinal plants used in the Zerhoun region -Morocco. Int. J. Innov. Appl. Stud. 2016; 15(4): 846–863.
19. Bammi J, Douira A. Medicinal plants in the forest of Achach (central plateau, Morocco). J. Acta Bot. Mal, 2002; 27: 131-145.
20. Briguiche H, Zidane L. Ethnobotanical study of medicinal plants from El-Jadida City (Morocco). Lazaroa. 2016; 37: 145-151.
21. El Hilah F, Ben Akka F, Dahmani J, Belahbib N, Zidane L. Ethnobotanical study of medicinal plants used in the treatment of respiratory system infections in the central Moroccan plateau. J of An & Plant Sc. 2015; 25(2): 3886-3897.
22. Beaudet G, The central Moroccan plateau and its borders: a geomorphological study. Rabat: Imprimeries françaises et marocaines,1969.
23. Fennane M, Ibn Tattou M, Ouyahya J.A, El Oulaidi J. Practical flora of Morocco. Vol 1, Travaux de l'institut Scientifique, Ser. Botanique N 36 Rabat, 1999.
24. Fennane M, Ibn Tattou M, El Oulaidi J. Practical Flora of Morocco. Vol. 3, Travaux de l'institut Scientifique, Ser. Botanique N 40 Rabat. 2007a.
25. Fennane M, Ibn Tattou M, Ouyahya A, El Oulaidi J. Practical flora of Morocco. Vol. 2, Travaux de l'institut Scientifique, Ser. Botanique N 38 Rabat. 2007b.
26. Pardo-de-Santayana M, Tardío J, Blanco E, Carvalho AM, Lastra JJ, San Miguel E, Morales R. Traditional knowledge

on wild edible plants in the northwest of the Iberian Peninsula (Spain and Portugal): a comparative study. J of Ethnobio and Ethnomed. 2007; 3(27): 1-11.
27. Cadena-González AL, Sørensen M, Theilade I. Use and valuation of native and introduced medicinal plant species in Campo Hermoso and Zetaquira, Boyacá, Colombia. Jof Ethnobio and Ethnomed. 2013; 9: 1-34.
28. Nawash O, Shudiefat M, Al-Tabini R, Al-Khalidi K. Ethnobotanical study of medicinal plants commonly used by local Bedouins in the Badia region of Jordan. J of Ethnopharmacol. 2013; 148: 921-925.
29. Vitalini S, Iriti M, Puricelli C, Ciuchi D, Segale A, Fico G. Traditional knowledge on medicinal and food plants used in Val San Giacomo (Sondrio, Italy) —An alpine ethnobotanical study, J. Ethnopharmacol. 2013; 145: 517–529.
30. Yaseen G, Ahmad M, Sultana S, Suleiman Alharrasi A, Hussain J, Zafar M. Ethnobotany of Medicinal Plants in the Thar Desert (Sindh) of Pakistan. J of Ethnopharmacolo. 2015; 163: 43-59.
31. Najem M, Ibijbijen J, Nassiri L. Quantitative ethnobotanical study of poisonous medicinal plants used in the traditional pharmacopoeia of the Central Middle Atlas Region: Morocco. Ethnobot Res Appl. 2019; 18: 1–17.
32. Najem M, Ibijbijen J, Nassiri L, Appellations vernaculaires des plantes toxiques à usage médicinal dans le Moyen Atlas central- Maroc. Ethnobot. Res. Ap- plic, 2020; 20 (48): 1–30.
33. Najem M, Ibijbijen J , Nassiri L. Phytotherapy in response to COVID-19 and risks of intoxication: A field study in the city of Meknes (Morocco). J of Pharma & Pharmaco Res. 2022; 10(3): 357-386.
34. Najem M, Ibijbijen J, Nassiri L. Ethnobotanical treatment of respiratory diseases in the central Middle Atlas (Morocco): Qualitative and quantitative approach. Eur J Integrat Med. 2021; 46: 101358.
35. Heinrich M, Ankli A, Frei B, Weimann C, Sticher O. Medicinal plants in Mexico: Healers' consensus and cultural importance. Soc. Sci. Med, 1998; 47: 1859–1871.
36. Bennett B.C, Prance G.T. Introduced plants in the indigenous pharmacopoeia of Northern South America, Econ. Bot. 2000; 54 (1): 90–102.
37. Singh AP, Kumar M, Nagar B, Pala NA, Bussmann RW. Ethnomedicinal use of plant resources in Kirtinagar Block of Tehri Garhwal in Western Himalaya. Ethnobot Res & Ap. 2019;18(14): 1-11.
38. Tardio J, Pardo-de Santayana M. Cultural importance indices: a comparativeanalysis based on the useful wild plants of southern Cantabria (Northern Spain). Eco Bot. 2008; 62 (1): 24-39.
39. Kamalebo H.M, Malale H.N.S.W, Ndabaga C.M, Degreef J, Kesel A.D. Uses and importance of wild fungi: Traditional knowledge from the Tshopo province in the Democratic Republic of the Congo. J. Ehnobiol. Ethnomed. 2018;14: 1-13.
40. Hussain S, Malik F, Khalid N, Qayyum M.A, Riaz H. Alternative and traditional medicines systems in Pakistan: History, Regulation, Trends, Usefulness, Challenges, Prospects and Limitations. A Compendium of Essays on Alternative Therapy. London: InTech. 2012. 67 p.
41. Kanwal H, Sherazi B.A. Herbal medicine: Trend of practice, perspective, and limitations in Pakistan. Asian Pac. J. Health Sci, 2017; 4: 6–8.
42. Daoudi A, Bachiri L, Bammou M, Ibijbijen J, Nassiri L. Ethnobotanical study in the Central Middle Atlas. Eur Sci J. 2015; 11: 226–242.
43. Hakkou S, Sabir M & Machrouhi N. Touristic valorisation of natural resources, aromatic and medicinal plants of the Rabat-Sale-Kenitra region. Editions Universitaires Européennes. 2022. 148 p.
44. Benítez GC, González-Tejero MR, Molero-Mesa J. Pharmaceutical ethnobotany in the western part of Granada province (southern Spain): Ethnopharmacological synthesis. J Ethnopharmacol. 2010;129: 87–105.
45. Savo V, Giulia C, Maria GP, David R. Folk phytotherapy of the Amalfi Coast (Campania, Southern Italy). J Ethnopharmacol. 2011;135: 376–392.
46. Bhat J.A, Kumar M, Bussmann R.W. Ecological status and traditional knowledge of medicinal plants in Kedarnath Wildlife Sanctuary of Garhwal Himalaya, India. J Ethnobiol Ethnomed. 2013; 9: 1-18.
47. Barkaoui M, Katiri A, Boubaker H, Msanda F. Ethnobotanical survey of medicinal plants used in the traditional treatment of diabetes in Chtouka Ait Baha and Tiznit (Western Anti-Atlas), Morocco. J of Ethnopharmacol, 2017;198: 338–350.
48. Ziyyat A, Legssyer A, Mekhfi H, Dassouli A, Serhrouchni M, Benjelloun W. Phytotherapy of hypertension and diabetes in oriental Morocco. J of Ethnopharmacol. 1997;58 (01): 45–54.
49. Fennane M, Tattou M I, Valdés B. Catalog of rare, threatened or endemic vascular plants of Morocco. Published under the auspices of OPTIMA by Herbarium Mediterraneum Panormitanum. 1998.
50. Khatib S, Sobeh M, Bouissane L. Tetraclinis articulata (vahl) masters: An insight into its ethnobotany, phytochemistry, toxicity, biocide and therapeutic merits. Front in Pharmacol. 2022. 3514 p.
51. Rached W, Zeghada F.Z, Bennaceur M, Barros L, Calhelha, R. C, Heleno, S, Ferreira I.C. Phytochemical analysis and assessment of antioxidant, antimicrobial, anti-inflammatory and cytotoxic properties of Tetraclinis Articulata (Vahl) Masters leaves. Ind. Crops Prod. 2018;112:460–466.
52. Sadiki F. Z, El Idrissi M, Cioanca O, Trifan A, Hancianu M, Hritcu L, Postu P.A. Tetraclinis Articulata essential oil mitigates cognitive deficits and brain oxidative stress in an Alzheimer's disease amyloidosis model. Phytomedicine. 2018;15: 57–63.
53. Postu P. A, Tiron A, Tiron C. E, Gorgan D, Mihasan M, Hritcu L. Conifer essential oils reversed amyloid beta1-42 action by modulating BDNF and ARC expression in the rat hippocampus. CNS Neurol. Disord. Drug Targets. 2022;21 (1): 85–94.
54. Braca A, Sortino C, Politi M, Morelli I, Mendez J. Antioxidant activity of flavonoids from Licania licaniaeflora. J of ethnopharmacol. 2002; 79(3): 379-381.
55. Cimanga K, Ying L, De Bruyne T, Apers S, Cos P, Hermans N, Bakana P, Tona L, Kambu K, Kalenda D.T, Pieters L, Vanden Berghe D, Vlietinck A.J, Radical scavenging and xanthine oxidase inhibitory activity of phenolic compounds from Bridelia ferruginea stem bark. J. Pharm. Pharmacol. 2001.; 53: 757–761.
56. Montoro P, Braca A, Pizza C, De Tommasi N. Structure-antioxidant activity relationships of flavonoids isolated from different plant species. Food Chem. 2005; 92: 349–355.
57. Srinivasan R., Natarajan D., Shivakumar M.S. Antioxidant Compound Quercetin-3-O-α-L-rhamnoside (1→6)-β-D-glucose (Rutin) isolated from ethyl acetate leaf extracts of Memecylon edule Roxb (Melastamataceae). Free Radic. Antioxid. 2015;5: 35–42.
58. Kayani S, Ahmad M, Zafar M, Sultana S, Khan MPZ, Ashraf, M. A, Yaseen G. Ethnobotanical uses of medicinal plants for respiratory disorders among the inhabitants of Gallies – Abbottabad, Northern Pakistan. J Ethnopharmacol. 2014;156: 47–60.
59. Bouyahya A, Abrini J, Bakri Y, Dakka N. Screening phytochimique et évaluation de l'activité antioxydante et antibactérienne des extraits d'Origanum compactum. Phytothérapie. 2017;15(6): 379-383.
60. El Babili F, Bouajila J, Souchard PJ, Bertrand C, Bellvert F. Oregano: chemical analysis and evaluation of its antimalarial, antioxidant, and cytotoxic activities. J Food Sci. 2011; 76: 512–8.

61. Baudrand H, Mbatchou Ngahane B.H, Marcu M, Freymond N, Pacheco Y, Devouassoux G. Pneumopathie communautaire abcédée à Klebsiella pneumoniae. Rev. Mal. Respir. 2009:26 (7); 773–778.
62. Valour F, Chebib N, Gillet Y, Reix P, Laurent F, Chidiac C, Ferry T. Bronchopulmonary infections with Staphylococcus aureus. Revue de Pneumologie Clinique. 2013;69(6): 368-382.
63. Ali-Shtayeh M.S, Yaghmou R.M.R, Faidi Y.R, Salem K, Al-Nuri M. A. Antimicrobial activity of 20 plants used in folkloric medicine in the Palestinian area. J. Ethnopharmacol, 1998;60 (3): 265–271.
64. Sener A, Dulger B. Antimicrobial activity of the leaves of Verbascum sinuatum L. on microorganisms isolated from urinary tract infection. Afr J Microbiol Res. 2009; 3(11): 778-781.
65. Rehman N.U, Khan A.U, Alkharfy K.M, Gilani A.H. Pharmacological basis for the medicinal use of lepidium sativum in airways disorders. Evid. Based Complement. Alternat. Med. 2012;1 (8): 596-524.
66. Stahl-Biskup E, Venskutonis R.P. Kaunas University of Technology, Lithuania. Handbook of herbs and spices. 2004. 297 p.
67. Cabo J, Cabo M.M, Crespo M.E, Jiménez J, Zarzuelo A. Thymus granatensis IV. Pharmacodynamic study of its essential oil. Fitoterapia. 1986.
68. Cruz T, Jiménez J, Zarzuelo A, Cabo M.M. The spasmolytic activity of the essential oil of Thymus baeticus Boiss in rats. Phytother. Res. 1989; 3 (3): 106–108.
69. Zarzuelo A, Cabo M.M, Cruz T, Jiménez J. Spasmolytic action of the essential oil of Thymus longiflorus Boiss. in rats', Phytother. Res. 1989;3(1): 36-37.
70. Godfraind T, Miller R, Wibbo M. Calcium antagonism and calcium entry blockade. Pharmacol. Rev. 1986; 38 (4): 321-416.