USES OF MEDICINAL PLANTS COLLECTED FROM THE SENALBA CHERGUI FOREST (DJELFA PROVINCE, ALGERIA) BY THE RURAL POPULATION

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Abstract. This study aims to collect data on medicinal plants collected from Senalba Chergui forest (Djelfa, Algeria) and used in traditional medicine by the local population. An ethnobotanical survey was carried out with 107 informants through direct interviews using a structured questionnaire. The results showed that women (71%) use medicinal plants more than men, older people have more information than the young. Furthermore, the vast majority of users of medicinal plants are illiterate. 32 species belonging to 21 families and 27 genera are identified. The most used plants are *Herniaria hirsuta* L (93%), *Juniperus phoenicea* L (87%), *Pistacia lentiscus* L (86%), *Teucrium polium* L (80%), *Stipa tenacissima* L (79%), *Pinus halepensis* Mill (78%). %), *Thymus algeriensis* Boiss. et Reult (73%), *Artemisia herba-alba* Asso (72%), *Quercus ilex* subsp. *Ballota* (Desf.) Samp (72%), *Juniperus oxycedrus* subsp. *Rufescens* (Link) Deb (64%), *Rosmarinus officinalis* L (63%), *Stipa parviflora* Desf (61%), *Pistacia terebinthus* L (60%) and *Rosmarinus tournefortii* de Noé (50%). The Lamiaceae and Asteraceae families were dominant the most often, we emphasize that the leaves were the most used (53.13%). The results show that decoction (59.38%) was the most commonly used method to prepare remedies. It appears that gastrointestinal diseases were the most often treated mainly orally.
Keywords: *Senalba Chergui forest, sociodemographic, ethnobotanical plants, gastrointestinal diseases*

Introduction

Medicinal plants are widely used in traditional cultures all over the world and they are becoming increasingly popular in modern society as natural alternatives or supplements to synthetic chemicals (Van Wyk and Wink, 2018). In Africa, medicinal plants are valuable resources for rural and urban populations and represent the primary means by which individuals heal themselves (Badiaga, 2011). Despite progress in pharmacology, the therapeutic use of medicinal plants is present in certain countries of the world, particularly in developing countries (Tabuti et al., 2003).

Over the centuries, human traditions have developed the knowledge and use of medicinal plants for the treatment of human diseases (Richard et al., 2004). The World Health Organization estimates that 65 to 80% of the world's population uses medicinal plants to meet their primary health needs, due to poverty, and difficulties in accessing modern medicine centers and it is also part of sociocultural behavior (WHO, 2013;

Hadjadj et al., 2020a; Khalfa et al., 2022). Indeed, around 25% of modern medicines are derived from plants (Verma and Singh, 2008). The majority of medicinal plants contain chemical compounds with antioxidant properties (Benabdallah, 2016).

With an area of 2,381,741 km^2, Algeria is known for its plant diversity. The Algerian flora is estimated at around 4,300 autochthonous taxa and nearly 4,500 taxa if we count introduced species (cultivated, weeds, naturalized) (Dobignard and Chatelain, 2010-2013; Hadjadj et al., 2020b). Endemic taxa number 464 species throughout Algeria (Vela and Benhouhou, 2007). The arid and semi-arid zones of Algeria, such as the steppe region of Djelfa, present specific characteristics either by the species that constitute them, but also by the structure and diversity of plant formations (Abi-Salah et al., 1976).

Furthermore, populations living near the forests of the Djelfa region use medicinal plants to treat certain illnesses. The objective of this research is to identify the medicinal plants collected from the Senalba Chergui Forest (Djelfa province) and to determine the medicinal use of each plant.

Materials and methods

Study area

The Sénalba Chergui natural forest (36°36′ N–36°42′ N, 3° E−3°12′ E) is 3 km northwest of the city of Djelfa in the central region of the Ouled Nail mountain range in the Saharan Atlas (*Fig. 1*). The range runs from southwest to northeast with a maximum elevation lower than 1300 m. The low-relief landscape is due to its lithological homogeneity (marly limestone) (Mouissa and Fournier, 2013). The pedogenic features that characterize Sénalba soils are primarily limestone accumulations, and shallow depths (Mouissa et al., 2018).

The Senalba Chergui forest extends over an area of 19.830 ha, divided into 12 series. These forest series were established in 1983 by the Djelfa forest administration (Guit and Nedjimi, 2020). The Senalba massif is essentially composed *Pinus halepensis* Mill associated with *Quercus ilex* subsp. *Ballota* (Desf.) Samp, *Juniperus phoenicea* L, *Juniperus oxycedrus* subsp. *Rufescens* (Link) Deb, *Rosmarinus tournefortii* de Noé and *Stipa tenacissima* L.
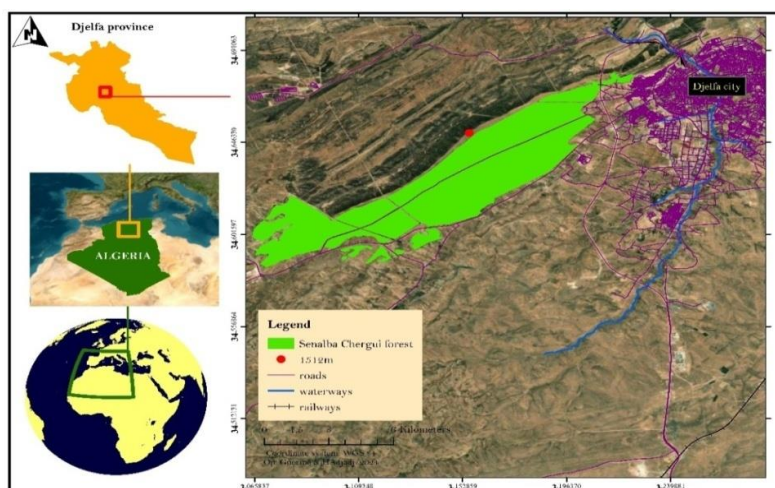

Figure 1. *Location of the Senalba Chergui Forest*

Methods

The surveys were carried out from March to June 2022 among a sample of 51 households near the Senalba Chergui forest. The location of households was carried out in collaboration with the forestry services of the province of Djelfa. Our survey sample is composed of N = 107 people. In this survey, the number of women surveyed was greater than the number of men because we based ourselves on the principle that it is women who have the know-how of traditional medicine and it is they who prepare the care recipes (Bouallala et al., 2014; Hadjadj et al., 2019; Meddour et al., 2022).

The content of the questionnaire sheets is designed to collect as much information as possible on the profile of the informant (age, sex, level of education, the origin of the information, etc.) and the therapeutic uses of the most commonly medicinal plants used by the population (pathologies treated, part used, method of use, etc.). Let us remember that the species cited by the people interviewed were identified in the field using the synonymous and bibliographic index of the Maghreb flora (Dobignard and Châtelain, 2010-2013). It is essential to mention that no specimen is collected and deposited in the botany laboratory of the University of Djelfa.

For the processing of the collected data, we relied on the work of Orsot (2016), Singh et al. (2012), and Pradhan and Singh (2019) to determine the Citation Frequency ($FC = \dfrac{n}{N}*100$) of a species which corresponds to the ratio between informants mentioning the use of the species (n) and the total number of informants participating in the survey (N).

Citation frequency reflects the traditional importance of each species regarding the informants who cited these medicinal species (Shehla et al., 2017). High FC can be explained by wide distribution and indigenous cultivation to treat various diseases using these species (Sadaf et al., 2015). Highly cited plants need to be evaluated and analyzed in detail from the point of view of their pharmaceutical and biological properties (Schmeda-Hirschmann et al., 2002).

Results

Sociodemographic profile of informants

According to our results, women and men use medicinal plants to treat certain illnesses. However, women predominate with a rate of 71% (*Table 1*). The use of medicinal plants among rural people is widespread in all age groups with a predominance of people over 60 years old (44.9%) and [30-59 years] old (37.4%). The age group [30 years] is only represented with a rate of 17.7% (*Table 1*). These results show that older people know more about traditional medicine than other age groups. The vast majority of users of medicinal plants are illiterate, with a percentage of 56.1%, followed by primary level (17.8%) and secondary level (13.1%). The use rate was low for the other levels' middle and university levels (9.3% and 3.7%, respectively). In terms of the origin of information on treatment with medicinal plants among those interviewed, we observe that the vast majority of the population refers to the experiences of others (82.2%).

Floristic analysis

The floristic analysis made it possible to determine 32 medicinal species classified into 21 botanical families and 27 genera. It turns out that the Lamiaceae family is the most

represented with 15.63%, followed by the Asteraceae family with 9.38%. We emphasize that the families Anacardiaceae, Plantaginaceae, Cistaceae, Poaceae, and Cupressaceae are represented by two species, i.e. a rate of 6.25%. In the end, the remaining families (14 botanical families) only have one species, which represents a rate of 3.13% (*Table 2*).

Table 1. *Informants sociodemographic profile*

Factor	Categories	Rate (%)
Sex	Men	29
	Women	71
Age	< 30	17.7
	[30-59]	37.4
	≥60	44.9
Education level	Illiterate	56.1
	Primary level	17.8
	Middle level	9.3
	Secondary level	13.1
	University level	3.7
Origin of the information	Experiences of others	82.2
	Therapists	15.9
	Documentations	1.9

Table 2. *Medicinal plants cited by informants*

Scientific name	Botanical families	Used parts	Diseases therapy	Preparation methods	Used methods	FC (%)
Eruca vesicaria (L.) Cav.	Brassicaceae	Seeds	Intestinal parasites	Decoction	Oral	7
Pistacia lentiscus L	Anacardiaceae	Leaves	Stomach ache, peptic ulcer, rheumatism	Decoction	Oral	86
Pistacia terebinthus L		Leaves	Diabetes	Decoction	Oral	60
Atractylis polycephala Coss.	Asteraceae	Root	Cholelithiasis	Decoction	Oral	29
Artemisia herba-alba Asso		Aerial part	Digestive disorders	Infusion	Oral	72
Pallenis spinosa (L.) Cass. subsp. *spinosa*		Aerial part	Skin lesions, eczema	Powder	External application	29
Pinus halepensis Mill	Pinaceae	Bark	Digestive disorders	Decoction	Oral	78
Herniaria hirsute L	Caryophyllaceae	Leaves	Cholelithiasis	Decoction	Oral	93
Ruta montana L	Rutaceae	Leaves	Skin lesions	Powder	External application	18
Thymus algeriensis Boiss. Et Reult	Lamiaceae	Leaves	Dental diseases, gingivitis, mouth ulcers	Infusion	Mouthwash	73
Teucrium polium L		Leaves	Stomach ache, peptic ulcer, digestive disorders	Decoction	Oral	80
Rosmarinus officinalis L		Leaves	Digestive disorders	Infusion	Oral	63
Rosmarinus tournefortii de Noé		Leaves	Gastrointestinal spasms	Infusion	Oral	50
Salvia verbenaca L Briq		Leaves	Skin lesions	Powder	External application	19
Rumex bucephalophorus L	Polygonaceae	Aerial part	Hemorrhoids	Decoction	Oral	11
Thapsia villosa L	Apiaceae	Aerial part	Rheumatism	Decoction	Oral	13
Euphorbia falcata L	Euphorbiaceae	Aerial part	Intestinal parasites	Decoction	Oral	9
Plantago albicans L	Plantaginaceae	Leaves	Prostate	Decoction	Oral	14
Globularia alypum L		Leaves	Stomach ache, hemorrhoids	Decoction	Oral	18

Medicago lupulina L	Fabaceae	Leaves	Skin lesions	Powder	External application	13
Malva aegyptia L	Malvaceae	Leaves	Constipation	Infusion	Oral	36
Asphodelus microcarpus Salzm. et Viv	Liliaceae	Aerial part	Rheumatism	Decoction	Oral	17
Cistus villosus L	Cistaceae	Aerial part	Rheumatism	Infusion	Oral	21
Cistus salviifolius L		Aerial part	Rheumatism	Infusion	Oral	18
Phillyrea angustifolia L	Oleaceae	Leaves	Digestive disorders	Decoction	Oral	24
Quercus ilex subsp. *Ballota* (Desf.) Samp	Fagaceae	Fruits	Digestive disorders	Powder	Oral	72
Stipa tenacissima L	Poaceae	Aerial part	Hypercholesterolemia	Decoction	Oral	79
Stipa parviflora Desf		Aerial part	Intestinal worms	Decoction	Oral	61
Juniperus phoenicea L	Cupressaceae	Leaves	Gastrointestinal spasms	Decoction	Oral	87
Juniperus oxycedrus subsp. *Rufescens* (Link) Deb		Leaves	Cholestérol	Decoction	Oral	64
Papaver rhoeas L	Papaveraceae	Fruits	Digestive disorders	Infusion	Oral	22
Eryngium campestre L	Apiaceae	Leaves	Gastrointestinal spasms	Decoction	Oral	25

The parts used

According to the results obtained, we note that the leaves are the most frequently used plant parts with a ratio of 53.13%, followed by the aerial part with a rate of 31.23%. The fruits of some plants are also used but at a low rate (6.25%). The bark, roots, and seeds are represented with the same percentage of 3.13% (*Fig. 2*).
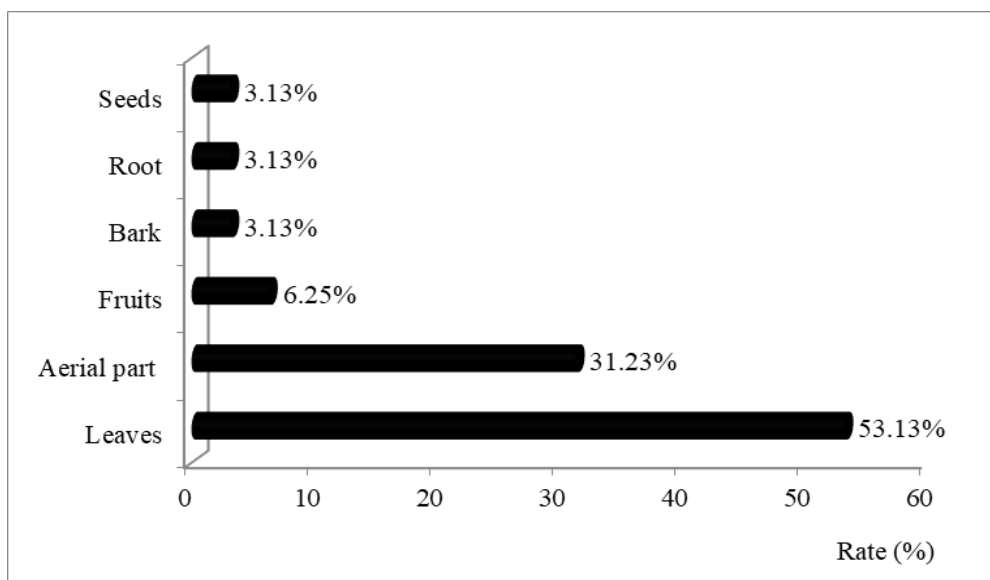

Figure 2. Frequency of use of medicinal plant parts (%)

Methods of preparation

How medicinal plants are used by the local populations of the Senalba Chergui forest are diverse: decoction, infusion, and powder. The most common preparation method is decoction with a ratio of 59.38%. A rate of 25% represents infusion mode and the powder mode is ranked last with a percentage of 15.62% (*Fig. 3*). Users of medicinal plants suggest that decoction and infusion allow better extraction of active ingredients from plants, thus reducing toxicity and disinfecting the plant.
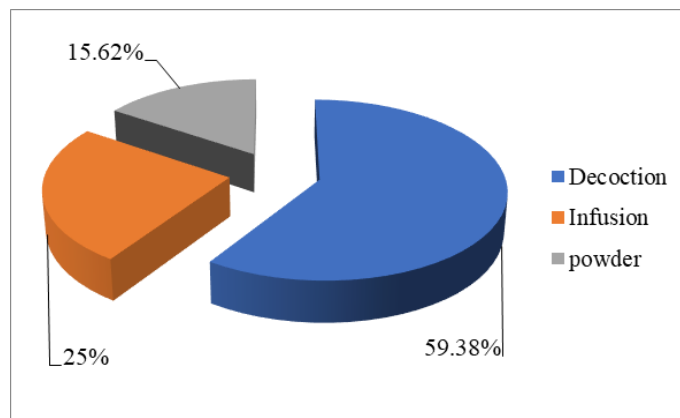
Figure 3. *Modes of preparation used by indigenous practitioners*

Use methods

Oral administration represents the most frequent method (84.37%). There are also two other methods of administration, external application (12.5%) and mouthwash (3.13%). The oral route is used mainly for decocted and infused plants (*Fig. 4*).

According to those interviewed, the oral route is the most used method because most of the pathologies treated are internal diseases.
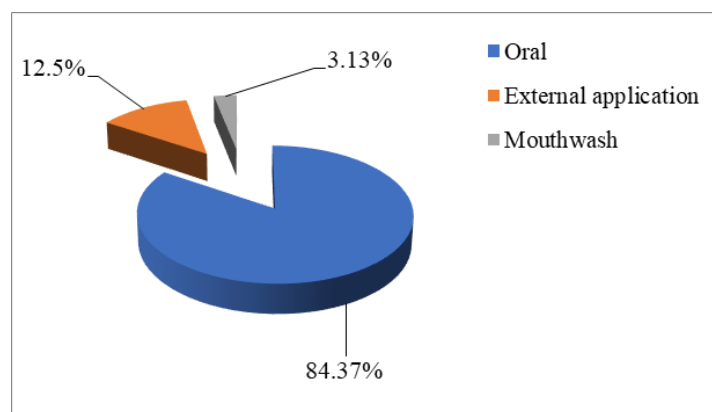

Figure 4. *Frequency of method of administration (%)*

Categories of diseases treated

Through the ethnobotanical analysis, we were able to identify different categories of diseases treated by medicinal plants (*Fig. 5*). Generally speaking, the most treated category of diseases is that of gastrointestinal disorders (53.13%), followed by skin diseases and rheumatic diseases. It should be noted that urinary and metabolic diseases are represented at 9.37%. Finally comes the category of dental diseases with a percentage of 3.13%.

The frequency citation

The species showing a high degree of FC were (*Table 2*): *Herniaria hirsuta* L (93%), *Juniperus phoenicea* L (87%), *Pistacia lentiscus* L (86%), *Teucrium polium* L (80%),

Stipa tenacissima L (79%), *Pinus halepensis* Mill (78%), *Thymus algeriensis* Boiss. et Reult (73%), *Artemisia herba-alba* Asso (72%), *Quercus ilex* subsp. *Ballota* (Desf.) Samp (72%), *Juniperus oxycedrus* subsp. *Rufescens* (Link) Deb (64%), *Rosmarinus officinalis* L (63%), *Stipa parviflora* Desf (61%), *Pistacia terebinthus* L (60%), *Rosmarinus tournefortii* de Noé (50%).
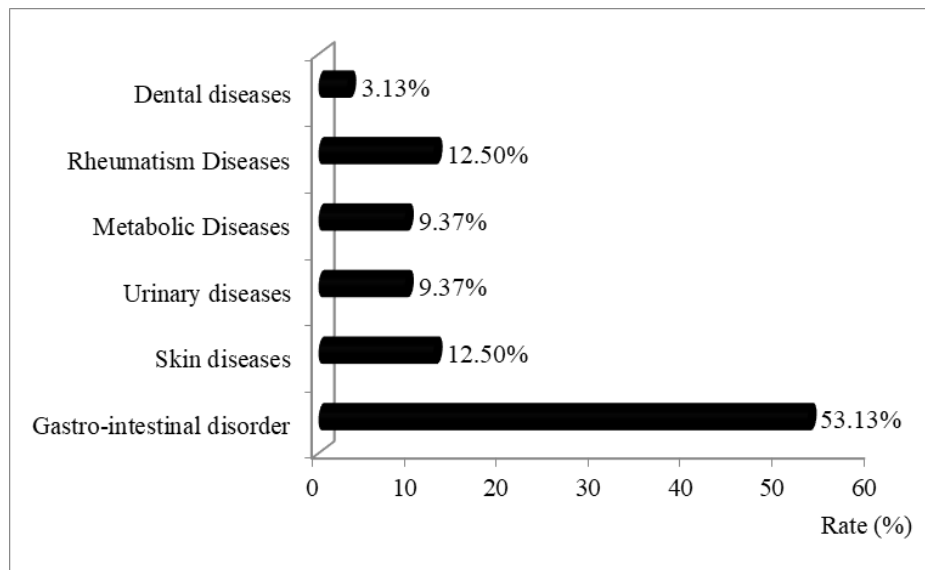

Figure 5. *Frequency of categories of diseases treated (%)*

Discussion

The results obtained during this research in the forest of Senalba Chergui (province of Djelfa, Algeria) show that medicinal plants are important in populations living near the forest. This trend towards plants is often linked to traditional know-how passed down from generation to generation (WHO, 2003).

Through this research, we identified 32 medicinal species classified into 21 botanical families and 27 genera. These plants allow rural populations to treat six categories of diseases (gastrointestinal disorders, skin diseases, rheumatic diseases, urinary diseases, metabolic diseases, and dental diseases). We emphasize that the medicinal species identified in this research are practically used particularly in several regions of Algeria in alternative medicine. The difference is mainly observed in the method of preparation and administration and the diseases treated. For example, *Artemisia herba-alba* Asso is used in our case by infusion against digestive disorders, then in Laghouat region the plant is indicated against skin and oral diseases (Hadjadj et al., 2019; Saidi et al., 2023). The leaves of *Malva aegyptia* L are used by infusion by the population surveyed against constipation. In the Setif region, the leaves and seeds are indicated by the same method against toothache and hemorrhoids (Chermat and Gharzouli, 2015). The bark of *Pinus halepensis* Mill is indicated in our case by decoction to treat digestive disorders, but it is rather used in the region of Tiaret as a paste against burns and osteoarthritis (Djahafi et al., 2021).

Our results showed that the most predominant families were Lamiaceae and Asteraceae. The dominance of these families is a particular and remarkable observation throughout the Mediterranean region (Gonzalez-Tejero et al., 2008; Meddour et al.,

2020), particularly in Morocco (Mehdioui and Kahouadji, 2007; Tahri et al., 2012) in Tunisia (El Mokniet al., 2013), Spain (Bonet and Vallès, 2003; Belda et al., 2013) and Algeria (Benaissa et al., 2018; Hadjadj et al., 2019).

For the used parts of plants, studies carried out on medicinal plants in North Africa (Algeria, Tunisia, Morocco) have demonstrated that the leaves and the aerial part are the plant organs most used in traditional medicine (El Hassani et al., 2013; Karous et al., 2021; Zatout et al., 2021; Benamara et al., 2022...). This observation can be explained by the fact that the leaves require less effort to obtain than other parts, notably the underground organs, and plant exudates (gums, resins). They are also the main photosynthetic organs of plants; therefore, they could be considered as rich sources of bioactive compounds (Zatout et al., 2021).

Concerning the method of preparation, the decoction was the most used. Our results confirm the results previously found in North African countries (El-Darier et al., 2021; Bencheikh et al., 2021; Belhouala and Benarba, 2021; Senouci et al., 2023), the countries of Europe (González-Hernández et al., 2004; Vitalini et al., 2009; Hayta et al., 2014; Karpavičienė, 2022), Asian countries (Wiart, 2006; Ghulam et al., 2019) and countries of 'South America (Goleniowski et al., 2006; Coutinho et al., 2015).

Digestive disorders are the pathologies most treated by the population surveyed. This result is observed in various regions of Algeria including the region of M'sila (Sarri et al., 2015), the region of El Harrouch and Azzaba (Souilah et al., 2018), the region of Naâma (Hadjadj et al., 2019), the Aures region (Baziz et al., 2020), Djurdjura region (Meddour and Sahar, 2023). This observation is also reported in Morocco by Tahri et al. (2012), Fadil et al. (2015) and Gourich et al. (2022). In Tunisia, medicinal plants are mainly used to treat this type of illness (Ben Salah et al., 2019).

Most remedies were administered orally in the form of decoction, powder, or infusion. Frequent disorders of the digestive system explain the high frequency of oral administration. This form of administration may be the most convenient and safest (Ruiz and Scioli Montoto, 2018). Another possible explanation could be linked to the addition of certain solvents or additives such as water which would increase the extraction of bioactive molecules during the preparation of the remedy while minimizing their harmful and toxic effects (Redouan et al., 2020; Baziz et al., 2022).

Conclusion

Medicinal plants play an important role for the rural population who live near the Senalba Chergui forest. Most communities in the study area use traditional medicine to treat certain diseases. This research will improve knowledge of medicinal plants harvested in this forest for adequate and rational use. A total of 32 plant species have been reported to treat various diseases such as digestive disorders, skin diseases, rheumatism, metabolic diseases, urinary diseases, and dental diseases. We cite as an indication *Herniaria hirsuta* L, *Juniperus phoenicea* L, *Pistacia lentiscus* L, *Teucrium polium* L, *Stipa tenacissima* L, *Pinus halepensis* Mill, *Thymus algeriensis* Boiss. et Reult, *Artemisia herba-alba* Asso, *Quercus ilex* subsp. *Ballota* (Desf.) Samp, *Juniperus oxycedrus* subsp. *Rufescens* (Link) Deb, *Rosmarinus officinalis* L, *Stipa parviflora* Desf, *Pistacia terebinthus* L, *Rosmarinus tournefortii* de Noé have the highest FC. To conclude, we suggest that these plants should be subjected to in-depth phytochemical studies to identify their main bioactive compounds.

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