

Ethnobotany and taxonomy of medicinal plants used for the treatment of pathologies of the respiratory system: case of the Saida region - Western Algeria)

Etnobotânica e taxonomia das plantas medicinais utilizadas para o tratamento de patologias do aparelho respiratório: caso da região de Saida - Argélia Ocidental)

Etnobotánica y taxonomía de plantas medicinales utilizadas para el tratamiento de patologías del sistema respiratorio: caso de la región de Saida - Argelia Occidental)

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ABSTRACT

Medicinal plants contain active ingredients with varied therapeutic properties, useful in the treatment of numerous pathologies. The aim of this study is to identify plants with therapeutic potential for respiratory ailments in the wilaya of Saïda, located in south-west Algeria. An ethnobotanical survey was carried out between 2023 and 2024, based on structured individual interviews using a pre-established questionnaire. A total of 337 participants, including healers, herbalists and local people with traditional knowledge, contributed to the study. It identified 34 plant species belonging to 33 genera and 16 families. Lamiaceae dominate with 7 species, followed by Apiaceae (5 species), Myrtaceae and Asteraceae (3 species each), then Linaceae and Liliaceae (2 species each). The other families have only one species. The most commonly used parts are leaves (37.2%), followed by fruits (5.7%), seeds (6.5%) and flowers (4.2%). The main galenic forms used

are herbal teas, prepared as infusions, decoctions or macerations, with administration mainly by mouth. Respiratory ailments treated include colds, asthma, nasal congestion, coughs and Covid-19. Plant citation frequencies (FC %) remain contrasted, ranging from 24.35% for *Thymus capitatus* to 6.16% for *Mentha spicata*. This study provides a database of plants with therapeutic potential in the treatment of respiratory ailments.

Keywords: ethnobotany, respiratory system, diseases, traditional phytotherapy, citation frequency, Saïda.

RESUMO

As plantas medicinais contêm princípios activos com propriedades terapêuticas variadas, úteis no tratamento de numerosas patologias. O objetivo deste estudo é identificar as plantas com potencial terapêutico para as afecções respiratórias na wilaya de Saïda, situada no sudoeste da Argélia. Foi realizado um inquérito etnobotânico entre 2023 e 2024, com base em entrevistas individuais estruturadas, utilizando um questionário pré-estabelecido. Um total de 337 participantes, incluindo curandeiros, ervanários e pessoas locais com conhecimentos tradicionais, contribuíram para o estudo. O estudo identificou 34 espécies de plantas pertencentes a 33 géneros e 16 famílias. As Lamiaceae dominam com 7 espécies, seguidas das Apiaceae (5 espécies), Myrtaceae e Asteraceae (3 espécies cada), depois Linaceae e Liliaceae (2 espécies cada). As outras famílias têm apenas uma espécie. As partes mais utilizadas são as folhas (37,2%), seguidas dos frutos (5,7%), das sementes (6,5%) e das flores (4,2%). As principais formas galénicas utilizadas são os chás de ervas, preparados como infusões, decocções ou macerações, com administração principalmente por via oral. As doenças respiratórias tratadas incluem constipações, asma, congestão nasal, tosse e Covid-19. As frequências de citação de plantas (F.C %) permanecem contrastantes, variando de 24,35% para *Thymus capitatus* a 6,16% para *Mentha spicata*. Este estudo fornece uma base de dados de plantas com potencial terapêutico no tratamento de doenças respiratórias.

Palavras-chave: etnobotânica, aparelho respiratório, doenças, fitoterapia tradicional, frequência de citação, Saïda.

RESUMEN

Las plantas medicinales contienen principios activos con propiedades terapéuticas variadas, útiles en el tratamiento de numerosas patologías. El objetivo de este estudio es identificar plantas con potencial terapéutico para dolencias respiratorias en la wilaya de Saïda, situada en el suroeste de Argelia. Se realizó una encuesta etnobotánica entre 2023 y 2024, basada en entrevistas individuales estructuradas utilizando un cuestionario preestablecido. Un total de 337 participantes, entre curanderos, herboristas y población local con conocimientos tradicionales, contribuyeron al estudio. Se identificaron 34 especies vegetales pertenecientes a 33 géneros y 16 familias. Lamiaceae domina con 7 especies, seguida de Apiaceae (5 especies), Myrtaceae y Asteraceae (3 especies cada una), y luego Linaceae y Liliaceae (2 especies cada una). Las demás familias sólo tienen una especie. Las partes más utilizadas son las hojas (37,2%), seguidas de los frutos (5,7%), las semillas (6,5%) y las flores (4,2%). Las principales formas galénicas utilizadas son las tisanas, preparadas como infusiones, decocciones o maceraciones, con administración principalmente por vía oral. Las afecciones respiratorias tratadas incluyen resfriados, asma, congestión nasal, tos y Covid-19. Las frecuencias de citación de las plantas (F.C %) siguen siendo contrastadas, oscilando entre el 24,35% de *Thymus capitatus* y el 6,16% de *Mentha spicata*. Este estudio proporciona una base de datos de plantas con potencial terapéutico en el tratamiento de dolencias respiratorias.

Palabras clave: etnobotánica, sistema respiratorio, enfermedades, fitoterapia tradicional, frecuencia de citas, Saïda.

1 INTRODUCTION

A major challenge of our time remains the effective and sustainable treatment of diseases that have increased with the high rate of urbanization. For this reason, plants have always been used as remedies for ailments of the various systems of the human body. According to the OMS (2012), plants are natural, local resources essential to mankind. In addition to cultivated plants, the majority of wild plants have proven socio-cultural and socio-economic importance, thanks to their nutritional and therapeutic properties (Baba Aissa, 1999; Benem and Sanou-Nana, 2009; Benkhniue *et al.*, 2010; Bammou *et al.*, 2014). Plant resources strongly influence the demographic and civilizational development of certain communities, according to the work of Salhi *et al.*, (2010).

In Africa, medicinal plants are a precious resource for the vast majority of rural populations, over 80% of whom use them for health care (Jiofack *et al.*, 2010; Aouedj *et al.*, 2020a; Sedikki; 2021; Belgacem Nouar *et al.*, 2021; Hasnaoui *et al.*, 2023; Ghomid *et al.*, 2023; Draiaia *et al.*, 2024; Terras *et al.*, 2024).

Despite the rise of modern medicine, industrial treatments such as antibiotics and analgesics are not accessible to all due to financial and material constraints (Tabuti *et al.*, 2003). As a result, medicinal plants continue to play a central role in the treatment of chronic and disabling diseases, particularly in Africa and North Africa, where floristic diversity constitutes a precious phylogenetic reserve (Alistiqsa *et al.*, 2017).

In Algeria, this rich plant heritage translates into around 3,139 species of spermaphytes, of which almost 1,000 have medicinal virtues and 700 are endemic (Belouad; 1998). However, the exploitation of medicinal and aromatic plants remains limited despite their potential for the cosmetics, pharmaceutical and food industries (Abdelguerfi and Ramdane, 2003; Reguieg, 2011).

Phytotherapy in Algeria is applied by traditional practitioners, herbalists and people with ancestral knowledge in traditional medicine. It is transmitted orally and is widely practiced mainly by low and middle income families. The present study, carried out in the wilaya of Saïda, aims to identify the medicinal plants used by the local population to treat respiratory conditions and the way in which they are treated. This type of work was not previously carried out in the wilaya, hence its interest.

2 METHODOLOGY

2.1 PRESENTATION OF THE STUDY REGION

The wilaya of Saïda is a region located in south-west Algeria, occupying an area of 75.62 km². It is characterized by its geographical and climatic diversity. The geographical coordinates of this study area are 34° 50' 00" North latitude and 0° 09' 00" East longitude. The average altitude is

868 meters, but this can oscillate between a minimum of 730 meters and a maximum of 1230 meters. These characteristics strongly influence the local climate and human activities. The population of the wilaya of Saïda is estimated at around 350,000 in 2024, divided between urban areas, where most of the infrastructure is concentrated, and rural areas where agriculture and livestock breeding play a central role in the local economy. Saïda's climate is semi-arid, with marked seasonal contrasts. Summers are generally hot and dry, while winters are cold, with low temperatures and frequent frosts. Average annual rainfall is around 348 mm, which is relatively modest, but sufficient to support Mediterranean-type vegetation.

2.2 CONCEPTUALIZATION OF THE RESEARCH METHODOLOGY

The survey was carried out over the period from 2023 to 2024, using carefully designed questionnaire forms to collect reliable and accurate data. To ensure that the results were as representative as possible, a stratified random sampling plan was implemented. This enabled the sample to be distributed evenly across the wilaya's 16 communes, guaranteeing complete coverage of the area under study. The main objective of the survey was to document the traditional uses of local medicinal plants in the treatment of respiratory disorders. To achieve this, interviews were conducted with key informants, chosen for their knowledge of traditional practices and their experience in using plants from the local pharmacopoeia.

Discussions were guided by a pre-designed survey sheet, structured to gather detailed and specific information. This included several sections on the plant species used, their preparation methods, their therapeutic applications, and the beliefs and knowledge associated with their use. Thanks to this rigorous process, it was possible to draw up a complete list of medicinal plants traditionally used in the study area, while respecting local knowledge and its intergenerational transmission. This methodology, which is both scientific and respectful of traditional knowledge, has enabled us to highlight the importance of local practices in the management of respiratory disorders, thus contributing to the enhancement of the region's phytotherapeutic heritage. A total of 120 healers and herbalists were interviewed, and 217 members of the region's population with ancestral knowledge were interviewed; a total of 337 people. Semi-structured interviews were used, and information was collected on the local names of the plants used, the parts used as drugs, and the methods of preparation and administration of medicinal recipes.

The medicinal plant species indicated by the informants were photographed on accessible specimens in their natural environment and harvested for a herbarium. These species were identified using the standard keys of Quézel et Santa (1962-1963). According to Daget and Godron (1982),

this technique is suitable for investigations over a wide geographical area, in a relatively short time and with limited resources.

2.3 DATA PROCESSING CALCULATION OF VARIOUS PERCENTAGES

In order to better highlight our results, we have carried out detailed calculations of percentages related to various aspects of local phyto-therapeutic practices. These analyses include the proportions of plant organs used, remedy preparation techniques and modes of administration, with the aim of identifying the most widespread and popular uses among local populations. In addition, we determined the “Indices of Relative Cultural Importance (IICR)”, an essential tool for assessing the degree of knowledge and use of plant resources by the communities studied. These indices are based on a fundamental principle: the more frequently a plant is mentioned by informants, the more culturally and medically significant it is considered to be. The most frequently mentioned species reflect strong relevance and dominant use, while those mentioned less frequently reveal less interest.

To calculate these indices, we used key data such as the frequency of species citation (F.C) by participants and their relative exploitation level (R.E.L).

1- Citation frequency (C.F):

$$F.C (\%) = \frac{n}{N} \times 100$$

The F.C. of each species surveyed was calculated according to the formula of Monnet (2013), which translates into the ratio between the number of respondents (n) who mentioned the species and the total number of people interviewed (N) during the survey. This ratio is then multiplied by 100. Schrauf and Sanchez (2008) consider citation frequency to be a good index for assessing the credibility of the information received. As such, they are of greater importance than those that are cited less or infrequently. Assuming that all species can be cited by any participant.

2- Relative exploitation level (R.E.L):

$$R.E.L(\%) = \frac{a}{A} \times 100$$

The R.E.L was obtained by taking the ratio between the number (a) of conditions treated by a species and the total number (A) of conditions treated by all species (N'guessan *et al.*, 2015). This ratio is then multiplied by 100. The R.E.L values obtained were used to qualify the level of exploitation of the various species. Species are divided into the following categories: ii-Very well exploited species if R.E.L is between 75 and 100%; ii-Well exploited species if R.E.L is between 50 and 75%; iii-Moderately exploited species if R.E.L is between 25 and 50%; iv-Little exploited species if R.E.L is between 1 and 25%; v- Unexploited species if R.E.L = 0.

This approach has made it possible to rank plants according to their perceived importance, providing a clear and objective view of traditional knowledge and practices related to local pharmacopoeia. These results make a valuable contribution to the enhancement of cultural heritage and the preservation of ancestral knowledge on the use of medicinal plants.

3 RESULTS AND DISCUSSION

3.1 INVENTORY AND ETHNOBOTANY

We counted 34 medicinal plant species from 33 genera and 16 botanical families (Table I).

Table I: Taxonomy of plants used to treat respiratory diseases

Family	Scientific Name	Local name	Number of citations	F.C %	Diseases treated
Lamiaceae	<i>Thymus capitatus</i>	Al-zaater	75	24.35	Rh; An; Tx; Tr; Cn; Pn; Al
	<i>Mentha spicata</i>	Al-naanaa	19	6.16	Tr; Rh; Al; An; Pn; Tx; Cn
	<i>Rosmarinus officinalis</i>	Ikli jabel	4	1.29	An; Tr; Br
	<i>Ajuga iva</i>	Chendgoura	5	1.62	An
	<i>Lavandula dentata</i>	Khzama	4	1.29	Rh; Tr; Al
	<i>Salvia officinalis</i>	Miramiya	2	0.64	An
	<i>Marrubium vulgare</i>	Maryout	1	0.32	As; An
Myrtaceae	<i>Syzygium aromaticum</i>	Al-kronfol	21	6.81	Rh; As; An. Tr; Tx; Al; Cn
	<i>Eucalyptus globulus</i>	Kalitous	33	10.71	Rh; An; Tx; Tr; Cn; Pn; Br, Al
	<i>Myrtus communis</i>	.Rayhan	1	0.32	Pn; Br; Cn
Asteraceae	<i>Artemisia absinthium</i>	Achiba	13	4.22	Rh; Al; Cn; Tx
	<i>Cladanthus mixtus</i>	Babouneg	5	1.62	Pn; Tx; Rh; Al; Tr
	<i>Artemisia herba-alba</i>	Chih	9	2.92	As; Tr; Tx
Apiaceae	<i>Thapsia garganica</i>	Bounafea	3	0.97	An
	<i>Cuminum cyminum</i>	Kamoun	3	0.97	Rh; Tx
	<i>Pimpinella anisum</i>	Habet halawa	1	0.32	Tr
	<i>Anethum graveolens</i>	Zariat besbes	2	0.64	Rh; As
	<i>Ammoides verticillata</i>	Noukha	4	1.29	Rh; Tx; Al
	<i>Coriandrum sativum</i>	Al qasbûr	1	0.32	An
Zingiberaceae	<i>Zingiber officinalis</i>	Al-zanjabil	25	8.11	An; Rh; Pn; Tx; Cn; Tr; Br; Al
	<i>Curcuma longa</i>	Korkom	7	2.27	Pn; Tx; As; An
Fabaceae	<i>Glycyrrhiza glabra</i>	Arq-sous	9	2.92	An; As; Tr; Rh; Br; Cn; Al
	<i>Trigonella foenum-graecum</i>	Helba	1	0.32	As; Pn
Liliaceae	<i>Allium cepa</i>	Basla	6	1.94	Rh; An
	<i>Allium sativum</i>	Al thoum	3	0.97	Rh; Cn
Rutaceae	<i>Citrus limon</i>	Laymoun	13	4.22	An; Tx; Rh; Cn

Oleaceae	<i>Olea europea</i>	Al-zaytoun	11	3.57	An; Cn; Tx; Rh
Renonculaceae	<i>Nigella sativa</i>	Haba sawdaa	11	3.57	Rh; An; As; Br; Cn; Al
Cupressaceae	<i>Cupressus sempervirens</i>	Al araar	2	0.64	As; Rh
Verbenaceae	<i>Verbena officinalis</i>	Baymout	1	0.32	Rh; Tr
Schisandraceae	<i>Illicium verum</i>	Yanson	2	0.64	Al
Linaceae	<i>Linum usitatissimum</i>	Bedor ketan	1	0.32	An; Tx
Brassicaceae	<i>Brassica rapa</i>	Left	2	0.64	Tr; Al
Lauraceae.	<i>Cinnamomum verum</i>	Kerfa	8	2.59	An; Tx; Rh

Source: Elaborated by the authors (2024)

The survey enabled us to list 34 plant species that can be used to treat respiratory ailments. The most commonly used families are: Lamiaceae (20.58%), Apiaceae (17.64%); Asteraceae (8.82%), Myrtaceae, (8.82%), Zingiberareae, Fabaceae, and the Liliaceae (5.88% each; 17.66% in total) and the remainder distributed between the other families with a total of 26.47% (2.94% for each family). Four families are dominant (Lamiaceae, Apiaceae, Asteraceae and Myrtaceae), accounting for over 55.7% of the total, with the remainder divided between the remaining 12 families.

3.2 GENERAL DATA AND PHYTOTHERAPY

It should be noted that many of the species used to treat respiratory ailments are natural and widespread in Algeria, such as *Thymus*, *Olea* ; *Mentha*, *Artemisia*, *Myrtus* ; *Artemisia herba alba*; *Lavandula dentata* etc. Others, however, are imported (*Illicium verum*; *Melissa officinalis*; *Pimpinella anisum*, *Glycyrrhiza glabra*, *Cinnamomum verum*, *Zingiber officinalis*, *Syzygium aromaticum*).

The citation frequencies (C.F.) of species used in the treatment of respiratory ailments are highly contrasted, with values ranging from 24.35% to 0.32% (Table II). We have found it useful to classify them into three categories:

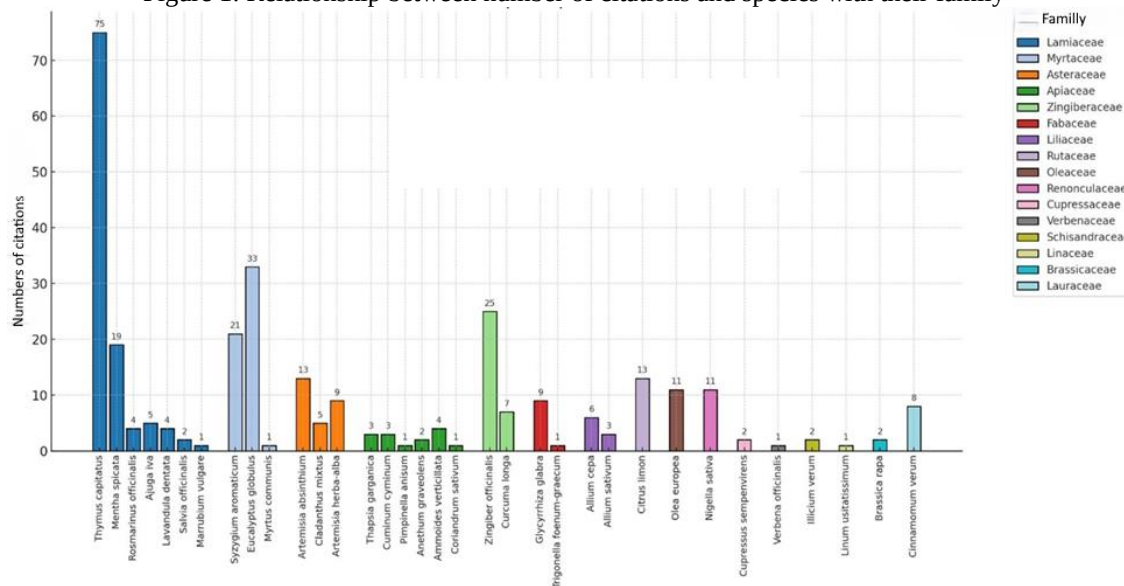
- i- Highly used plants: C.F is over 6%.
- ii-Moderately used plants: C.F below 6% and above 2%.
- iii- Low-use plants: C.F less than 2%.

Table II: Frequency of plant use

Classes	Citation Frequency (C.F%)	Species
i	$6\% \leq C.F$	<i>Thymus capitatus</i> - <i>Zingiber officinalis</i> - <i>Eucalyptus globulus</i> - <i>Syzygium aromaticum</i> - <i>Mentha spicata</i>
ii	$2\% \leq C.F \leq 6\%$	<i>Artemisia absinthium</i> - <i>Artemisia herba-alba</i> - <i>Curcuma longa</i> <i>Glycyrrhiza glabra</i> <i>Olea europea</i> - <i>Nigella sativa</i> - <i>Cinnamomum verum</i>
iii	$C.F \leq 2\%$	<i>Rosmarinus officinalis</i> - <i>Ajuga iva</i> - <i>Lavandula dentata</i> - <i>Salvia officinalis</i> - <i>Marrubium vulgare</i> <i>Myrtus communis</i> - <i>Cladanthus mixtus</i> - <i>Thapsia garganica</i> - <i>Cuminum cyminum</i> - <i>Pimpinella anisum</i> - <i>Anethum graveolens</i> - <i>Ammoides verticillata</i> <i>Coriandrum sativum</i> - <i>Trigonella foenum-graecum</i> - <i>Allium cepa</i> - <i>Allium sativum</i> <i>Cupressus sempervirens</i> - <i>Verbena officinalis</i> <i>Illicium verum</i> - <i>Linum usitatissimum</i> - <i>Brassica rapa</i> .

Source: Elaborated by the authors (2024)

Figure 1: Relationship between number of citations and species with their family



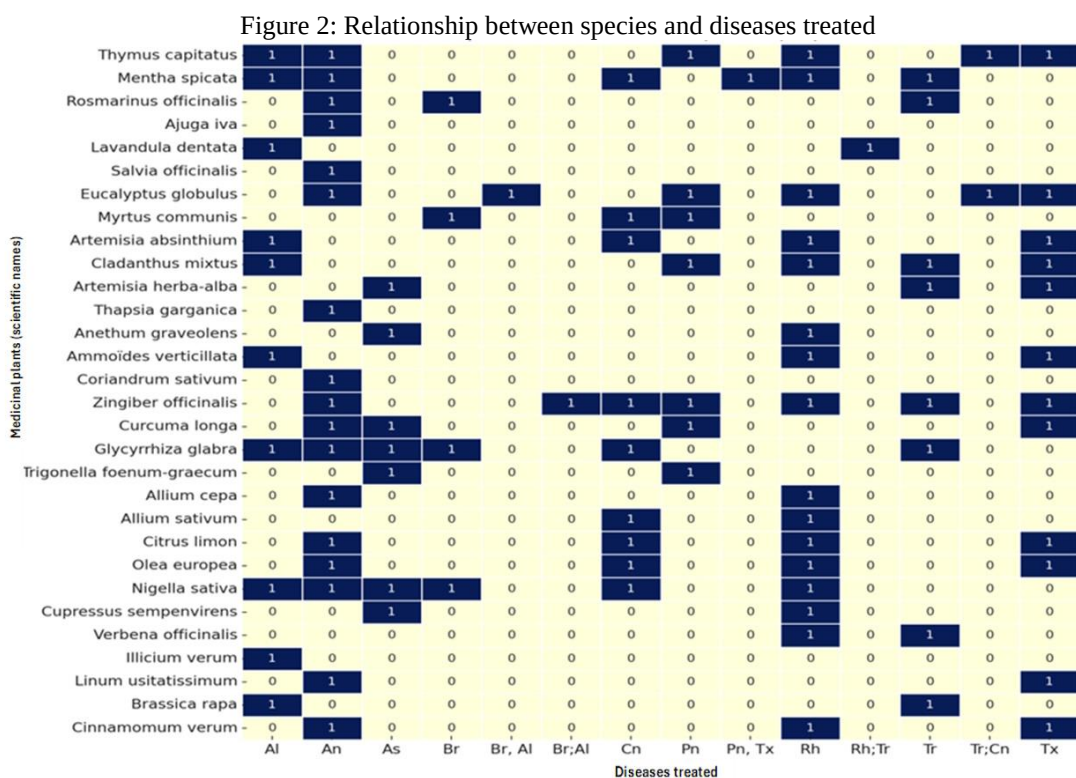
Source: Elaborated by the authors (2024)

3.3 THERAPEUTIC INDICATIONS

Diseases treated: We were able to identify 9 diseases treated by plants. We have codified them as follows: Cold (Rh); Asthma (As); Angina (An); Cough (Tx); Respiratory disorders (Tr); Nasal congestion (Cn); Pneumonia (Pn); Bronchitis (Br); Allergy (Al).

The species listed are used to treat 09 respiratory ailments: Cold, Asthma, Stuffy nose, Respiratory disorders; Angina, Chronic cough, Pneumonia, Acute bronchitis, Allergies (Table I).

Cold and angina (55.88%); cough and respiratory disorders (44.11%); nasal congestion (39.24%) Allergy (38.23%) asthma (26.47%), pneumonia (20.58%); bronchitis (17.64%). The most frequently cited were: 55.88%; 26.47%; 44.11% (Figure 2). These results corroborate those of Ghourri, *et al.* (2012); Ben Akka *et al.* (2019); Chaachouay *et al.* (2019); Draiaia *et al.*, (2024); who assert that respiratory system disorders are regularly treated by medicinal plants and mainly by *Zingyber*, *Eucalyptus*, *Mentha*, *Ammoides*, *Artemisia*, *Lavandula*, *Citrus*. It should be noted that modern medical treatments for respiratory ailments are expensive compared with herbal treatments. The latter could therefore be a viable alternative to counter these illnesses, particularly during cold periods (late autumn, winter and early spring). In-depth ethno-pharmacological research coupled with pragmatic political will would be required to develop effective, improved traditional medicines that meet the relevant standards for the well-being of the population. According to the information gathered during our field investigation, several plants can play the same role in the treatment of illnesses; nevertheless, the result varies according to the patient (age, standard of living, family history) (Figure 2).



Source: Elaborated by the authors (2024)

Figure 2 shows the correlation between medicinal plants and the ailments they are intended to treat. Citing frequencies vary significantly: the common cold tops the list with a citing frequency of 55.8%, followed by angina (52.9%), coughs (44.1%), and nasal congestion and respiratory disorders, which share a citing frequency of 35.2% each. Asthma is cited by 26.4%, pneumonia by 20.5%, and bronchitis by 17.6%.

3.4 PLANT SYNERGY

During our survey we found that certain plants have a cumulative power of therapeutic effects. The most frequently cited disease is Covid-19, in which the cumulative effect of the species' active ingredients acts as a potential inhibitor of Covid-19 (Table III). The galenic form is based on infusions and decoctions. The plants are subjected to one of the two forms after boiling the mixture. Generally, 2 to 3 species are used together. The mixture is taken as a hot herbal tea and/or for inhalation.

Table III: Cumulative effects of active plant ingredients in the treatment of Covid 19; asthma and chronic cough.

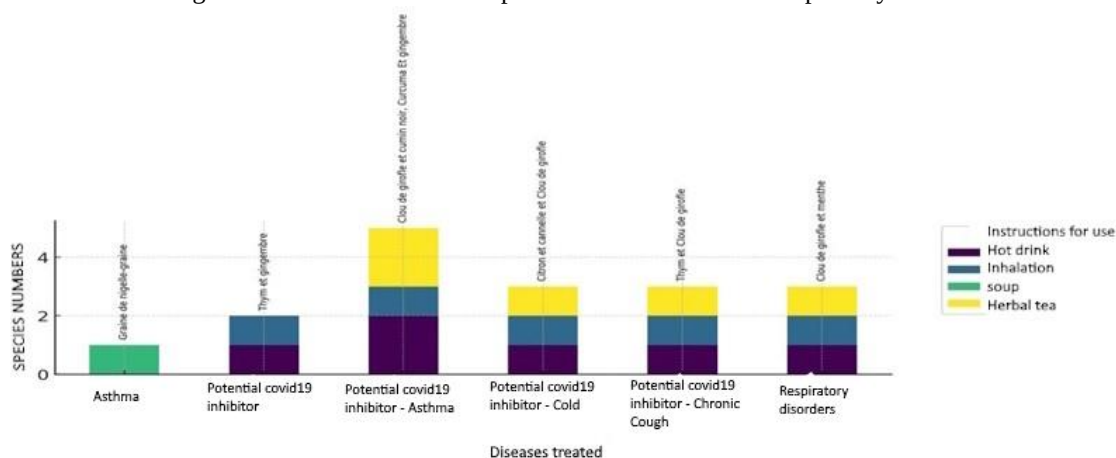
Species	Diseases treated	Instructions for use -
<i>Thymus capitatus</i> and <i>Zingiber officinalis</i>	Potential Covid 19 inhibitor -	1- Inhalation 2- Hot drink
<i>Syzygium aromaticum</i> and <i>Nigella sativa</i>	Potential Covid 19 Inhibitor - Asthma	Hot herbal tea
<i>Thymus capitatus</i> - <i>Citrus limon</i> and <i>Syzygium aromaticum</i>	Potential Covid 19 Inhibitor - Chronic Cough	1- Inhalation 2- Hot herbal tea
<i>Citrus limon</i> - <i>Syzygium aromaticum</i> and <i>Cinnamomum verum</i>	Potential Covid 19 inhibitor - Cold	1- Inhalation 2- Hot herbal tea
<i>Syzygium aromaticum</i> and <i>Mentha spicata</i>	Respiratory disorders	1- Inhalation 2- Hot herbal tea
<i>Nigella sativa</i> - <i>Linum usitatissimum</i> and <i>Trigonella foenum-graecum</i>	Asthma	Hot soup
<i>Curcuma longa</i> and <i>Zingiber officinalis</i>	Potential Covid 19 Inhibitor - Asthma	1- Inhalation, 2- Hot herbal tea
<i>Citrus limon</i> and Oil of <i>Olea europea</i>	Cold	Hot herbal tea

Source: Elaborated by the authors (2024)

In our survey of data sheets, we found that plants are used together to treat Covid 19, asthma and chronic coughs. The cumulative effect of the plants' active ingredients yields interesting results. The parts used depend on the plants employed (leaves (*Thymus*, *Mentha*), fruits [*Citrus*, *Trigonella*, *Olea*, *Nigella*, *Syzygium* and/or -rhizome, roots [*Zingiber*, *Curcuma*]). As for preparation, decoctions and infusions are the most commonly used. Once prepared, the solution is left to cool and drunk two or three times a day during the period of illness. It should be noted that some people inhale the products evaporated when the mixtures boil, and this is done during nasal congestion.

The results obtained in this investigation corroborate the work of Benarba and Pandiella (2020); Hamdani and Houari (2020); Al Alami *et al.* (2020) and Alyami *et al.* (2020).

Figure 3: Cumulative effect of plants in the treatment of respiratory diseases



Source: Elaborated by the authors (2024)

3.5 THERAPEUTIC USE VALUE

Analysis of the therapeutic use values of the species exploited has shown that they do not all enjoy the same real importance in the eyes of the target population. Some are more in demand and therefore more useful than others. It goes without saying that those that are more solicited will, for this reason, be subject to more anthropogenic pressures than those that are less solicited (Orekan *et al.*, 2013). This study reveals 6 species that are highly stressed (R.E.L. greater than 75%): *Thymus capitatus*; *Eucalyptus globulus*; *Syzygium aromaticum*, *Zingiber officinalis*. Other species are well solicited, such as: *Artemisia absinthium*- *Artemisia herba-alba*, *Curcuma longa*, *Glycyrrhiza glabra* - *Nigella sativa*- *Cinnamomum verum* on the other hand, 16 species are little used, with an R.E.L. of less than 25% (*Pimpinella anisum*-*Anethum graveolens*-*Ammoides verticillata* *Coriandrum sativum*- *Trigonella foenum-graecum*- *Cupressus sempervirens*- *Verbena officinalis*, *Illicium verum*-*Linum usitatissimum*).

3.6 PLANT PARTS USED

The percentage of use of these different parts shows that leaves are the most widely used, with a rate of 37.2%, favored for their medicinal properties and ease of harvesting. The whole plant follows with 28.9%, maximizing therapeutic effects. Plant oils (8%), seeds (6.5%) and fruits (5.7%) are also commonly used for their nutrients and specific properties. Flowers (4.2%) provide aromatic compounds, and the upper part of the plant (5.4%) is rich in active compounds. Stems (3%) and roots (1.2%) are used less, but remain important. This breakdown shows the diversity and richness of ethnobotanical practices.

Similarly, the ethnobotanical survey carried out by Ghourri *et al.* (2012) on the use of medicinal plants for the treatment of respiratory illnesses in the wilaya of Mila revealed that leaves are the most widely used parts, accounting for 55% of cases. As for the other parts used, fruit peels and bulbs are employed at frequencies of no more than 15% and 10% respectively, while roots and stems are little used.

In phytotherapy, medicinal plants can be used whole or in part. The most commonly used parts are leaves, stems, fruit and roots. The predominance of the use of one organ over another in the therapeutic field derives from the ease and rapidity of their collection, as well as the concentration of active principles in that organ. Leaves are the most widely used, as they are both the central organs of photochemical reactions and the reservoirs of essential organic matter responsible for the plant's biological properties.

They provide the majority of alkaloids, heterosides and oils. The predominance of leaf use is confirmed by our results, which indicate that leaves are the most commonly used parts, accounting

for 37.2% of total use. Roots, on the other hand, are the least used, accounting for just 1.2%. These results are consistent with the work of Belouad (1998), which also shows that leaves are among the most frequently used plant parts.

3.7 METHOD OF USE AND QUANTITY TAKEN PER DAY

The study conducted by kadri *et al.* (2028) reveals that the southern population mainly prefers to use medicinal plants in liquid galenic form (decoction, infusion) with a rate exceeding 51%. The use of plants in their raw state is also common, reaching 32%. Maceration is used at a rate of 7%, and cooking is the least popular method, with only 2%. Benlamdini *et al.* (2014) state that the best use of a plant is one that preserves all its properties while extracting the majority of its active ingredients.

The mode of use varies from one person to another, as we found that taking the preparation orally (i.e. internal use) is for the majority of respondents, 80.7%, followed by external use (by inhalation or application) for 19.3% of respondents. Furthermore, the quantity used per day is 60.7% once in total, 29.8% twice a day and 8.3% three times a day.

4 CONCLUSION

Our results show the effect of medicinal plants in the traditional treatment of diseases of the respiratory system. The catalog of physiologically active plants we have compiled could lead several specialties to study them and, perhaps, discover new products that could enter the modern therapeutic arsenal. In fact, we believe that the plants used to treat pathologies of the respiratory system have given good results, according to the information provided by our interviewees: *Thymus ciliatus*, *Eucalyptus globulus*, *Citrus limon*, *Myrtus communis*, *Zingiber officinalis*, *Syzygium aromaticum* and *Artemisia herba alba*. These species have been used to treat certain pathologies such as colds, asthma and coughs, and have been shown to inhibit the potential of Covid 19. For this reason, they deserve more attention in the phytotherapeutic field. Further scientific investigation is needed to understand the mechanism of action of these plants and their optimal use.

However, it is important to bear in mind that these plants are in increasing decline as a result of human activity. In fact, safeguarding traditional pharmacopoeias requires conservation of the living material heritage, which is a prerequisite for their long-term survival.

Future work will focus on the phytochemical screening of the main plants in order to know their active molecules involved in the treatment of respiratory diseases.

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