ETHNOBOTANICAL STUDY ON THE USE OF MEDICINAL PLANTS WITH ANTIVIRAL INTEREST, CASE OF SARS-COV-19, IN THE REGION OF SERAIDI (ANNABA, NORTH-EAST ALGERIA)

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Description of the study area

The Edough massif enters the sub-humid bioclimatic conditions: altitude, bioclimate, topography, substrate, soil, floors,... In addition, this forest is characterized by the presence of the most beautiful formations of cork oak (Quercus suber), Zen oak (Quercus faginea), with their floral procession, to which are added groups of maritime pine (Pinus pinaster) and chestnut (Castanea sativa) (Toubal, 1989).

The Edough massif enters the sub-humid bioclimatic stage, according to the pluvial-thermal quotient of Emberger (1957), with the highest temperatures being observed in August and the lowest in January. Precipitation is mainly encountered during the cold seasons, exceeding 900 mm (Bouzid, 2019).

Materials and Methods

The taxonomic diversity and the richness of the region of Seraidi (North-East Algeria) in medicinal plants, as well as the appearance of diseases of viral origin, in particular, the current pandemic of SARS-CoV-2, led us to the realization of an ethnobotanical survey of plants with antiviral interests. The survey was conducted based on a pre-established quiz, with 120 people from different categories of the population of Seraidi, with the aim of listing the medicinal plants used in the treatment of viral diseases and collecting as much information as possible on this subject. After analyzing, the information provided by the people interviewed, we listed 32 species belonging to 20 families, of which the Lamiaceae family is the most represented. Older women are the most affected by the use of plants; people without a higher intellectual level have the most knowledge about the use of plants with antiviral interest. The leaf is the most widely used organ, in the form of a decoction or infusion, administered orally.

Keywords: Medicinal plants with antiviral interest, Seraidi, ethnobotanical survey, traditional use, local population.
Ethnobotanical survey

In order to collect and constitute a source of information ready to be exploited on the scientific level, in the field of the valorization of medicinal plants with antiviral interest, an ethnobotanical investigation was carried out.

This information was collected using a questionnaire. The answers to the elaborated questions were made through conversations with healers, herbalists and rural women’s cooperatives installed in the Seraidi region and the local population.

The people, who agreed to share their knowledge with us in the antiviral interest, enabled us to draw up a technical sheet (Figure-01), containing the following information: the vernacular name of the plants; the method of preparation, route of administration; and parts of the plants used.

The survey took place between July 2020 and September 2021, using the quiz that was submitted to people in direct contact with the medicinal plants mentioned above, throughout the Seraidi region. The number of people questioned is 120, of different ages, of different intellectual levels, and divided between the two sexes.

The information collected in the technical sheets has been processed and analyzed. At the same time, a bibliographical research was developed for the scientific identification of the listed taxa, in order to be able to select the species having an antiviral activity with the aim of sustainable valorization, through an in-depth phytochemical study. To do this, we consulted online documentation related to plant systematics and taxonomy (INPN, 2022; APGIII, 2009; APGIV, 2016).

![Figure 1: Quiz on medicinal plants with antiviral interest adopted for the ethnobotanical survey](image)
Results and Discussion

Inventory of medicinal plants with antiviral interest

Our ethnobotanical study has identified 32 medicinal plants with antiviral properties used by the population of the Seraidi region. Table-01 provides information on the listed species, specifying the scientific names in French and Arabic, the part of the plant used, the method of preparation, and the route of administration.

Table 1 : Médicinal Plants with anti viral Properties and their route of Administration

<table>
<thead>
<tr>
<th>No.</th>
<th>Scientific name</th>
<th>Family</th>
<th>Vernacular name</th>
<th>Part used</th>
<th>Method of preparation</th>
<th>Route of administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td><em>Origanum vulgare</em> L.</td>
<td>Lamiaceae</td>
<td>Oregano</td>
<td>Leaves</td>
<td>Decoction / Infusion / Poultice</td>
<td>Oral / Inhalation</td>
</tr>
<tr>
<td>02</td>
<td><em>Thymus capitatus</em> (L.) Hoffmans. &amp; Link</td>
<td>Lamiaceae</td>
<td>Thyme</td>
<td>Leaves</td>
<td>Decoction / infusion</td>
<td>Oral / Inhalation</td>
</tr>
<tr>
<td>03</td>
<td><em>Lavandula angustifolia</em> Mill.</td>
<td>Lamiaceae</td>
<td>Lavender</td>
<td>Leaves / Flowers</td>
<td>Decoction / Poultice / Raw</td>
<td>Oral / Direct application</td>
</tr>
<tr>
<td>04</td>
<td><em>Thymus vulgaris</em> L.</td>
<td>Lamiaceae</td>
<td>Thyme</td>
<td>Leaves</td>
<td>Infusion / Decoction</td>
<td>Oral</td>
</tr>
<tr>
<td>05</td>
<td><em>Artemisia herba-alba</em> Asso.</td>
<td>Asteraceae</td>
<td>Wormwood</td>
<td>Leaves</td>
<td>Decoction / Infusion / Maceration</td>
<td>Oral</td>
</tr>
<tr>
<td>06</td>
<td><em>Zingiber officinale</em> Roscoe</td>
<td>Zingiberaceae</td>
<td>Ginger</td>
<td>Rhizomes</td>
<td>Decoction / Infusion / Maceration / Raw</td>
<td>Oral</td>
</tr>
<tr>
<td>07</td>
<td><em>Curcuma longa</em> L.</td>
<td>Zingiberaceae</td>
<td>Curcuma</td>
<td>Rhizomes</td>
<td>Decoction / Direct application</td>
<td>Oral</td>
</tr>
<tr>
<td>08</td>
<td><em>Glycyrrhiza glabra</em> L.</td>
<td>Fabaceae</td>
<td>Licorice</td>
<td>Rhizomes</td>
<td>Direct application / Infusion / Decoction</td>
<td>Oral</td>
</tr>
<tr>
<td>09</td>
<td><em>Cinnamomum zeylanicum</em> Blume</td>
<td>Lauraceae</td>
<td>Cinnamon</td>
<td>Rhizomes</td>
<td>Decoction</td>
<td>Oral</td>
</tr>
<tr>
<td>10</td>
<td><em>Eucalyptus globules</em> Labill.</td>
<td>Myrtaceae</td>
<td>Eucalyptus</td>
<td>Leaves</td>
<td>Decoction</td>
<td>Oral / Inhalation</td>
</tr>
<tr>
<td>11</td>
<td><em>Syzygium aromaticum</em> (L.) Merr. &amp; L.M. Perry</td>
<td>Myrtaceae</td>
<td>Clove</td>
<td>Flowers / Fruits</td>
<td>Essential oil / Infusion / Powder</td>
<td>Oral / Direct application</td>
</tr>
<tr>
<td>12</td>
<td><em>Allium sativum</em> L.</td>
<td>Amaryllidaceae</td>
<td>Garlic</td>
<td>Bulbs</td>
<td>Raw / Fresh juice / Poultice / Maceration</td>
<td>Oral / Direct application</td>
</tr>
<tr>
<td>13</td>
<td><em>Pistacia lentiscus</em> L.</td>
<td>Anacardiaceae</td>
<td>Lentiscus</td>
<td>Leaves / Flowers / Fruits</td>
<td>Essential oil / Maceration / Powder / Infusion</td>
<td>Oral / Direct application</td>
</tr>
<tr>
<td>14</td>
<td><em>Allium cepa</em> L.</td>
<td>Amaryllidaceae</td>
<td>Onion</td>
<td>Bulbs</td>
<td>Decoction / poultice / Raw / Fresh juice</td>
<td>Oral / Direct application</td>
</tr>
<tr>
<td>15</td>
<td><em>Olea europaea</em> L.</td>
<td>Oleaceae</td>
<td>Olive</td>
<td>Leaves / Fruits / seeds</td>
<td>Essential oil / Raw / Decoction</td>
<td>Oral / Direct application</td>
</tr>
<tr>
<td>16</td>
<td><em>Verbena officinalis</em> L.</td>
<td>Verbenaceae</td>
<td>Verbena</td>
<td>Leaves</td>
<td>Decoction / Infusion</td>
<td>Oral</td>
</tr>
<tr>
<td>17</td>
<td><em>Citrus sinensis</em> (L.) Osbeck</td>
<td>Rutaceae</td>
<td>Orange</td>
<td>Leaves / Bark / Fruits</td>
<td>Decoction / Fresh juice / Raw</td>
<td>Oral</td>
</tr>
<tr>
<td>18</td>
<td><em>Citrus limon</em> (L.) Burm.f.</td>
<td>Rutaceae</td>
<td>Limon</td>
<td>Fruits / Leaves</td>
<td>Decoction / Raw / Fresh juice</td>
<td>Oral</td>
</tr>
<tr>
<td>19</td>
<td><em>Mentha spicata</em> L.</td>
<td>Lamiaceae</td>
<td>Menthe</td>
<td>Leaves</td>
<td>Decoction / Raw</td>
<td>Oral</td>
</tr>
<tr>
<td>20</td>
<td><em>Cupressus arizonica</em> Greene</td>
<td>Cupressaceae</td>
<td>Cypress</td>
<td>Leaves / Rods / Flowers</td>
<td>Decoction</td>
<td>Oral</td>
</tr>
<tr>
<td>21</td>
<td><em>Melissa officinalis</em> L.</td>
<td>Lamiaceae</td>
<td>Lemon balm</td>
<td>Leaves</td>
<td>Infusion</td>
<td>Oral</td>
</tr>
<tr>
<td>22</td>
<td><em>Pulmonaria officinalis</em> L.</td>
<td>Boraginaceae</td>
<td>Pulmonary</td>
<td>Leaves</td>
<td>Infusion</td>
<td>Oral</td>
</tr>
<tr>
<td>23</td>
<td><em>Salvia officinalis</em> L.</td>
<td>Lamiaceae</td>
<td>Sage</td>
<td>Leaves</td>
<td>Decoction / Infusion</td>
<td>Oral</td>
</tr>
<tr>
<td>24</td>
<td><em>Artemisia absinthium</em> L.</td>
<td>Asteraceae</td>
<td>Absinthe</td>
<td>Leaves</td>
<td>Decoction / Fresh juice</td>
<td>Oral</td>
</tr>
<tr>
<td>25</td>
<td><em>Ziziphus lotus</em> (L.) Lam.</td>
<td>Rhamnaceae</td>
<td>Sidra</td>
<td>Leaves / Roots</td>
<td>Decoction</td>
<td>Oral</td>
</tr>
<tr>
<td>26</td>
<td><em>Nigella sativa</em> L.</td>
<td>Ranunculaceae</td>
<td>Black bean</td>
<td>Seeds</td>
<td>Raw / Decoction / Essential oil</td>
<td>Oral / Direct application</td>
</tr>
</tbody>
</table>
The 32 species listed are grouped into 20 families, the most represented of which is the Lamiaceae family, with 25%; the rest of the families are represented by a percentage varying from 3% to 6% (Figure-02).

This result is consistent with ethnobotanical work carried out in Algeria, Africa and the Mediterranean basin, where we observed the dominance of the Lamiaceae family (Benlamdini et al., 2014; Hseini and Kahouadji, 2007; Lahsissene et al., 2009; Boutabia et al., 2011; Brahmi et al., 2022; Dieye and Sarr, 2021; Kouame et al., 2021; Koudouvo, 2009).

We can also note that all the species identified in the Seraidi region were mentioned in the online survey conducted by Hamdani and Houari (2020), carried out on 500 people, including 49% suffering from COVID-19, in different regions of northern Algeria.

To this end, the most recommended medicinal plants with antiviral interest for the treatment and prevention against COVID-19 infection by the population of Seraidi, and cited in the majority of research work carried out in Algeria (Helali et al., 2019; Haoud and Mellali, 2021; Brahmi et al., 2022; Bouafia et al., 2021) and in Morocco (Benlamdini et al., 2014; Hseini and Kahouadji, 2007; Lahsissene et al., 2009; Belhaj and Zidane, 2021; Najem et al., 2022) are *Origanum vulgare*, *Thymus vulgaris*, *Zingiber officinale*, *Eucalyptus globulus*, *Artemisia herba-alba*, *Syzygium aromaticum*, *Allium sativum*, *Citrus limon*, *Melissa officinalis*, *Pulmonaria officinalis*, *Ziziphus lotus*, *Urtica dioica* and *Pistacia lentiscus*.

Recent studies (Sehailia and Chemat, 2021; Tshibang, 2020; Tahrioui et al., 2020; Asdadi et al., 2020; Boughendjoua et al., 2022; Tahrioui et al., 2020; Belhaj and Zidan, 2021; Fouedjou et al., 2021) have confirmed the efficacy of the molecules extracted from the antiviral plants cited above, as well as the recommendation of their use for the treatment of patients with SRAS-CoV-2.

### Ethnobotanical survey:

The information collected through the answers to the quiz was analyzed and discussed using the graphs illustrated below:

#### Use of medicinal plants with antiviral interest according to gender:

Data analysis has shown that medical knowledge is shared between men and women, with a slight advantage going to the latter, with percentages of 57.5% for the female sex and 42.5% for the male sex (Figure-03).

#### Use of medicinal plants with antiviral interest according to age:

The use of medicinal plants with antiviral interest is present in all age groups, with a predominance in people over 60 years old (33.33%). Then come the age groups [50-60] and [40-50] with a percentage of 23.33% and 20.83%, respectively. The age group [30-40] corresponds to a frequency of use of 14.16%. Among informants aged under

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**Fig. 02:** Distribution of botanical families used in the treatment of viral diseases in the Seraidi.

**Fig. 03:** Use of medicinal plants with antiviral interest according to sex

These results agree with the general rule of Mehdioui et al., 2007, who affirm that women are holders of great traditional phototherapeutic knowledge inherited from mother to daughter.

Several ethnobotanical works also confirm the finding of our study, eithernatally scale (Aribi, 2013; Boutabia et al., 2011; Chemat and Gharzouli, 2015; Hamel et al., 2018; Helali et al., 2020; Hamdani and Houari, 2020; Brahmi et al., 2022), or internationally (Koudouvo, 2009; Benkhnige et al., 2011; Laarbya, 2017; Dougnon et al., 2018; Rhattas et al., 2016; Kouame et al., 2021).
30, the percentage of use of plants is less important, with 8.33% (Figure-04).

Fig. 04: Use of medicinal plants with antiviral interest according to age

It should be noted that the elderly have a great knowledge of medicinal plants in general (local vernacular names, methods of use; parts used), thus preserving a heritage from their parents.

These results also indicate the existence of a close link between age and the degree of knowledge, confirming the reliability of the information held by the elderly, they hold a good part of the ancestral knowledge that is part of the local tradition (Anyinam, 1995; Tamboura et al., 1998; Hsein and Kahouadji, 2007; Binkhigue et al., 2011; Mahdioui et al., 2007; Benlamdini et al., 2014; Kouame et al., 2021).

However, Helali et al. (2020) reported that people between the ages of 18 and 30 are the most frequent users of medicinal plants (38%), while the lowest rate is noted among people over 60, with a percentage of 6.5%. Brahmi et al. (2022) observed the same results in western Algeria. The people interviewed in the two studies cited above live in urban areas, unlike the people questioned in this work, who live in mountainous and riverside areas.

Use of medicinal plants with antiviral interest according to family situation

According to the respondents, married people (79.16%) use medicinal plants with antiviral interest much more than single people (20.84%) (Figure-05). Users in couples are more interested in the field of herbal medicine (Boughrara, 2016).

Indeed, married people are affected by the minimization of expenses and pharmacists, mainly families with dependent children (Bakiri et al., 2016). These families use medicinal plants with antiviral interest as first aid against viral infections in order to lower fever and avoid convulsions. This has been confirmed through the results obtained from ethnobotanical studies conducted by Boutabba et al. (2011), El-Hafian et al. (2014), El-Hilah et al. (2015), Jdaidi and Hasnaoui (2016), Boughrara (2016) and Hamel et al. (2018).

The observed percentages of users of medicinal plants with antiviral interest, according to the level of study correlate perfectly with the percentages in relation to age, where the age groups [> à 60ans] and [50 – 60ans] correspond to people not having benefited from high-level studies (maximum college). However, high school students and university students whose age groups are less than 30 years old, correspond to the category of people whose use of plants is less important (< 9%).

Use of medicinal plants with antiviral interest according to level of study

The highest percentage of users of medicinal plants with antiviral interest was observed in the illiterate category, with a rate of 33.66%, followed by those with a level average of 30%. People with a primary level represent 15.83%. However, we noted, through the answers obtained, that high school students represent a percentage of use medicinal plants lesser, but not negligible, antiviral interest, with respectively 11.66% and 10.83% (Figure-06).
These results reflect the socio-cultural level of the local population of the Seraidi region, which has an agricultural vocation, thus favoring the development of local products (beekeeping, development of Aromatic and Medicinal Plants, breeding of cattle and goats, market gardening, etc.), on the one hand. On the other hand, we can see that the population has retained their knowledge regarding the use medicinal plants as a remedy for the various pathologies encountered, through the elderly.

These results are encountered in the work of Benlamdini et al. (2014), in Morocco, in the eastern High Atlas (High Moulouya), with a large percentage of illiterate users, medicinal plants with antiviral interest. Academics, on the other hand, are wary of the consumption of medicinal plants, for fear of confusion, since they have no knowledge of their identifications, their virtues and especially their toxicities.

However, our results contradict those reported by Helali et al. (2020), Hamdi and Houari (2020) and Brahmi et al. (2022), where the majority of users of herbal medicine have a university level, with the percentage varying from 60 to 90%, while people with an average, primary or illiterate level represent rates below 20%, this can be explained by the fact that the people interviewed are in urban areas, far from any contact with nature (Brahmi et al. 2022).

**Use of medicinal plants with antiviral interest according to the different parts of plant**

Our survey of medicinal plants with antiviral activity shows that the leaf is the most used organ (48.88%), followed by the fruits, which represent 8.88% each. The other parts, namely the stems, the roots, the seeds, and the bulbs, occupy a rate, of 3.84%. The bark is the least used part, with 2.22% (Figure-07).

The extensive use of the leaves is explained by the ease and speed of harvesting (Bitsindou, 1986), but also by the fact that they are the seat of photosynthesis and the storage of secondary metabolites responsible for the biological activities of plants in certain species (Bigendakou-polugenii and Lejoly, 1990). This is also reported in other works such as Ouattara (2006), Benknigue et al. (2010-2011), Boutabia et al. (2011), Zerbou et al. (2011), Tahri et al. (2012), Diatta et al. (2013), Cheramat and Gharyouli (2015), Jdaidi and Hasnaoui (2016) and Kouame et al. (2021).

The roots are among the parts of the plant least used in the preparations of therapeutic remedies, because the removal of the roots actively contributes to the destruction of the species (Koné, 2009; Bouayyadi, 2015; El Amrani, 2010; Slimani, 2016), knowing that the harvests are carried out in a spontaneous and uncultivated state. However, we observed root consumption of *Ziziphus lotus* and *Urtica dioica*. The use of bulbs is encountered in the genus *Allium, Allium cepa* and *Allium sativum*.

**Use of medicinal plants with antiviral interest according to the method of preparation:**

Users prepare phytomedicines with several methods. The decoction is the most frequent method with 26.59%, followed by the infusion with 21.52%, the powder with a percentage of 15.19%, the maceration at 10.12%, the poultice at 8.86%, the fresh juice at 6.33%, and the form gross at 6.33%. While the least used, being the use of essential oils, representing 5.06% (Figure-08).

Information on how to use medicinal plants and their therapeutic properties may differ from person to person (Serine, 2008). The preparation of medicinal plants by the method of decoction not only makes it possible to warm the body and disinfect it (Tahri et al., 2012), but also makes it possible to reduce toxicity when mixed with other plants, or even to cancel it altogether (Salhi et al., 2010).

**Use of medicinal plants with antiviral interest according to the route of administration:**

The plant preparations used for the treatment in a traditional way are often administered orally, inhaled or by direct application. The oral route is the most used with a frequency of 71.56%, direct application represents 23.33% and 5.11% of the plants are used in the form of inhalation (Figure-09).

Oral administration correlates with the method of preparation, by decoction, infusion, or maceration. This form of preparation can only be administered orally. This explains the high percentage of users of medicinal plants with antiviral interest by oral administration (Helali et al., 2020; Hamdi and Houari, 2020; Brahmi et al., 2022; Boutabia et al., 2011; Kouame et al., 2021; Chraibi et al., 2018).

The direct applications of medicinal plants with antiviral interest are found in turmeric, which is also considered, as a condiment, highly appreciated in the Algerian kitchen, and licorice, recommended as natural dental care.
The ethnobotanical survey carried out in the region of Seraidi (state of Annaba, North-East Algeria), relating to the traditional use of medicinal plants with antiviral interest by the local population, has brought us very considerable information that can be exploited in the field of the valorization of medicinal plants having antiviral activities. A number of 32 species have been identified by healers, herbalists, rural women’s cooperatives, as well as local people as medicinal plants used for their antiviral activities and the treatment and prevention against COVID-19. These 32 species are grouped into 20 families, of which the Lamiaceae family is the most represented with 25%.

The collection and analysis of the data collected from the interviewees showed that older women use medicinal plants with antiviral interest more than men. In addition, the frequency of use of these plants according to intellectual level has shown that people who have not pursued higher education have a better knowledge of medicinal plants. The leaves represent the most used part of the plant, administered orally after maceration, decoction, or infusion. The other parts of the plant are consumed to lesser degrees.

This ethnobotanical work oriented us towards a sharp selection of antiviral medicinal plants, with the aim of in-depth phytochemical study, which will be presented through other scientific and research publications.

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References


Ethnobotanical study on the use of medicinal plants with antiviral interest, case of SARS-COV-19, in the region of Seraidi (Annaba, North-East Algeria)