Chemical characterization of essential oil of *Artemisia herba-alba asso* and his possible potential against covid-19

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**ABSTRACT**

In this work, we studied the chemical composition of the essential oil obtained by hydrodistillation from the aerial parts of *Artemisia herba-alba* Asso growing wild in Tafingoult in Morocco. The oil yield was 0.71% based on dry weight. Chemical analysis by GC / MS identified twenty-five constituents representing 98.43% of the essential oil. Chrysanthenone (39.67%) was the main component of *A. Herba-alba* Asso. Moreover, a high content of oxygenated monoterpene characterizes this essential oil. This suggests that it has biological activities, namely antiviral activities of at least one of its constituents. Hence the idea of proposing the plant for scientific research as a potential source of antiviral molecules against COVID-19.

**Keywords:**


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1. **Introduction:**

COVID-19, launched in December 2019 in Wuhan in China. It is manifested by a severe acute respiratory syndrome caused by an emerging SARS-CoV-2 virus. Today the WHO declares it as a pandemic. SARS-CoV-2 is highly contagious, it has caused significant morbidity and mortality [1,2]. As of May 29, 2020, the number of people infected worldwide was 5,701,337 cases with 357,688 deaths [3]. To date, no approved vaccine or treatment are available for SARS-CoV-2. COVID-19 is therefore a big challenge for scientists to find an antiviral agent to treat it. Researchers are working to find antiviral agents, some of which are natural products: ritonavir, chloroquine phosphate, arbidol, ribavirin and traditional Chinese medicines that have shown preliminary efficacy against SARS-CoV [4].

Essential oils have shown promising antiviral activity against several pathogenic viruses, including those from the flu and other viral respiratory infections [5]. Indeed, many recent plant species have been the subject of much research. Their secondary metabolites have been retained as natural antivirals for the management of COVID-19 [6]. Thus a study carried out on several components of essential oils using molecular docking analysis with the main protease SARS-CoV-2 in order to find an alternative drug capable of blocking the activity of the converting enzyme angiotensin 2 (ACE2) as a receptor for SARS-CoV-2, a potential therapeutic target for COVID-19. Moreover, he has shown that these secondary metabolites can act synergistically, essential oils can therefore potentiate other antiviral agents against COVID-19 [5,7]. Similarly, another study found that isothymol is a functional inhibitor of ACE2 activity, suggesting that the components of the essential oil can be used as potential inhibitors of the ACE2 of SARS-CoV-2 receptor [8].

Due to the activities of several essential oils and essential oil components against human pathogenic viruses, we hypothesized that the components of *Artemisia herba alba* Asso essential oils potential antiviral agents for SARS-CoV-2. The World Health Organization (WHO) welcomes innovations from traditional pharmacopeia and the development of new therapies in the search for potential treatments for coronavirus 2019 disease (COVID-19) [9].

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Artemisia herba-alba Asso is used as an infusion in tea and in traditional medicine to treat colds, coughs, intestinal disorders and diabetes [10]. Scientific research on the medicinal properties of extracts of A. Herba alba have revealed anti-diabetic, leishmanicidal, anti-bacterial, anti-fungal, mutagenic, anti-mutagenic and antioxidant properties [11-20]. The white wormwood (Artemisia herba-alba) "Chih" is part of Artemisia genus containing over 450 species [21,22], spread over five continents. This seems to be of great economic interest in Morocco, which holds 90% of the world market for essential oil extracted from the plant [23]. This plant is one of the species that is widely used in classical medicine. In Morocco, it is represented by 19 species [24], the most important of which are: Artemisia alba sub sp. chitachensis, A. atlantica var. maroccana, A. flahauti, A. mesatlantica, A. negrei, A. ifranensis, A. herba-alba, A. arborescens and A. absinthium.

This agent is inexpensive and readily available and will be of great value if it is effective against SARS-CoV-2, so scientific efforts are needed to try to find a treatment for COVID-19.

2. Materials and methods:
2.1. Plant materials:
The sample of A. herba-alba Asso was collected in June 2015 near the Tafingoul village (30°46'44.0"N 8°23'50.0"W) in the Province of Taroudant (Morocco). The plant material consisted in the whole aerial parts formed by stems and flowers. Taxonomic identification of the species was confirmed and deposited in the Biotechnology Laboratory and Natural Resource Valuation of University Ibn Zohr, Planta Sud unity at Faculty of Sciences in Ibn Zohr University, Agadir, Morocco.

2.2. Oil isolation:
Air-dried plant material was ground and hydrodistilled for 3 h using a Clevenger-type apparatus according to the European Pharmacopoeia [25-27]. The obtained essential oil was weighed, filtrated on anhydrous sodium sulfate, and kept in an amber vial at 4°C until used.

2.3. Gas chromatography/mass spectrometry (GC/MS) analysis of essential oils:
The chemical compositions of essential oils were analyzed using a gas chromatograph (TRACE GC Ultra) fitted to a mass spectrometer (Polaris Q-Ion Trap MS). Operating in electron impact EI (70 eV) mode. VB-5 (Methylpolysiloxane 5% phenyl) and a column (30m x 0.25mm x 0.25µm thickness) were used (National Center for Scientific research and Technology (CNRST), Rabat, Morocco). The chromatographic conditions were as follows: Injector and detector temperatures at 220 and 300°C, respectively; carrier gas, helium at flow rate of 1.4 ml/min; temperature program ramp from 40 to 300°C with gradient of 4°C/min (holding the initial and final temperature for 4 min). The relative amount of individual components of the total essential oil was expressed as a percentage of peak area relative to the total peak area. Library search was carried out using the combination of data already available in the NIST 2005 and Mass Spectral Library in the literature [28].

3. Results and discussion:
Table 1 shows the qualitative and quantitative compositions of the oil analysed. Namely, it shows percentage compositions as well as the identities of compounds present in the essential oils of Artemisia herba-alba Asso. The yield of the essential oils (EOs) was 0.71% (v/w), calculated on a dry weight basis. Chemical composition of the EOs of Artemisia herba-alba Asso., was determined by GC/MS analyzes. The average yield obtained from essential oils extracted from the Artemisia herba-alba Asso plant studied is around 0.71%. This rate is relatively lower than that of the HE extracted from the same species collected in the region of Amskroud in Morocco (1.8%) [29], of Biskra (0.95%) [30], of M'sila (1.02%) [31] in Algeria and that of Jordan (1.3%) [32]. On the other hand, the essential oil yield of the species Artemisia herba-alba varies according to the harvest period in the Guerif region in Morocco; it is between 0.56% and 1.23% [33], in Spain, it varies according to source, from 0.41% to 2.30% [34]. The components of the essential oil were identified by GC-MS analyzes.

This study identified 25 constituents (representing 98.43% of essential oil). Furthermore, among the 300 volatile compounds reported in the literature [35], a large number of them have not been detected in the present work. The chromatographic analyzes of essential oils extracted (Tab. 1) have highlighted the predominance of the two oxygenated monoterpenes: chrysanthenone (39.67%) and camphor (13.34%). Some monoterpenes are present with relatively large percentages as α-thujone (12.87%), β-thujone (11.5%) and 1,8-cineol (4.3%). Other constituents are minor: tricyclene (0.11%), Sabine (0.13%) and α-terpinene (0.37%). Similar observations have been made by Paolini et al. [36] with 16 samples from Eastern Morocco, of which chrysanthenone, camphor, L’α- and β-thujone are the main compounds.

In addition, other authors have highlighted camphor (49.3%) in essential oils from the north of Algerian Sahara’s, while chrysanthenone (3.2%) remaining minor in these extracts [37].

However, some secondary chemical elements in this study have been described by other researchers as the majority of A. herba-alba essential oil’s. This is case for α-thujone, the main constituent of HE extracted by Paolini et al. (2010) [36] and those obtained by Sbayou et al. [38] in Taroudant in Morocco.

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and Spain. The davanone, 1,8-cineole and camphere have shown antiviral activity against the SARS coronavirus which appeared in 2002 [46]. Also, A. annua has shown significant activity against the SARS coronavirus which appeared in 2002 [47]. Since these components extracted from A. annua are not expensive and readily available, they will be of great value if they are effective against SARS-CoV-2. Scientific attention is therefore needed towards Artemisia species to find an effective treatment for COVID-19. So far, there are no effective vaccines or antiviral agents against coronavirus infections, so it is a challenge for scientists to find an antiviral agent to treat this disease.

Hence, our proposal for Artemisia herba-alba as a source of active ingredients that may have activity against SARS-CoV-2. Indeed, some authors have demonstrated that the antiviral activity of essential oils is attributed to their majority components [48]. In other words, the components of our essential oil extracted from Artemisia herba_alba Asso. Namely: α-pinene, p-Cymene, 1,8-Cineole, α-terpinene, γ-terpinene, terpinene-4-ol and α-terpineol have shown anti-viral action against herpes simplex virus type 1 which is dose dependent as components alone or as part of essential oils [49]. In fact, oils rich in components such as α-terpineol and camphene have shown antiviral activities in vitro on various viruses [5,49-55]. Other studies based on molecular docking analysis performed on several components of essential oils to look for possible drugs

Table 1: Chemical composition of the essential oil of Artemisia herba-alba Asso. By GC/MS analyses:

<table>
<thead>
<tr>
<th>Compounds</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>terpinéol</td>
<td>0,22</td>
</tr>
<tr>
<td>α-terpinéol</td>
<td>0,38</td>
</tr>
<tr>
<td>β-elemène</td>
<td>1,96</td>
</tr>
<tr>
<td>β-germacrène</td>
<td>1,37</td>
</tr>
<tr>
<td>α-munroliène</td>
<td>0,41</td>
</tr>
<tr>
<td>germacrene D-4-ol</td>
<td>1,07</td>
</tr>
<tr>
<td>davanone</td>
<td>0,79</td>
</tr>
<tr>
<td>Total identified</td>
<td>98,43</td>
</tr>
<tr>
<td>Yield of essential oils</td>
<td>0,71%</td>
</tr>
</tbody>
</table>

In addition, cis-chrysanthenyl acetate, which is considered to be the majority constituent of Biskra's HE in Algeria, is absent, for example, in our samples [30]. It seems that the species A. herba-alba is characterized by significant intra-specific variability in the chemical profile of its essential oils. Thus, the chrysanthenone-camphor (present work), α-thujone-camphor [39], camphor, thujone [36,39,40], chrysanthenone [36], davanone [40,41] chemotypes cis-chrysanthenyl acetate [40] are described in Morocco; those with 1,8-cineole and cis-chrysanthenol in Egypt; chrysanthenone [35] in Algeria; camphor is found in sagebrushes of the four countries: Morocco, Egypt, Algeria and Spain. The davanone, 1,8-cineole, chrysanthenone, cis-chrysanthenol and cis-chrysanthenyl acetate chemotypes are found in other Mediterranean areas [40,42]. The intra-specific variability existing within the species A. herba-alba can be of geographic, genetic [43], seasonal [33] or even ecological (soil, humidity, etc.) origin [36,43,44]. One of the most popular plants in traditional Chinese preparations is the Artemisia species, which are widespread around the world and are frequently used for the treatment of diseases such as malaria, hepatitis, cancer, inflammation and fungal, bacterial and viral infections. Extensive studies of the chemical components and essential oils of Artemisia have led to the identification of many very interesting compounds [45]. Indeed, bioactive compounds present in Artemisia annua are active against, the hepatitis B virus, the bovine viral diarrhea virus and the Epstein-Barr virus [46]. Also, A. annua has shown significant activity against the SARS coronavirus which appeared in 2002 [47]. Since these components extracted from A. annua are not expensive and readily available, they will be of great value if they are effective against SARS-CoV-2. Scientific attention is therefore needed towards Artemisia species to find an effective treatment for COVID-19. So far, there are no effective vaccines or antiviral agents against coronavirus infections, so it is a challenge for scientists to find an antiviral agent to treat this disease.
capable of blocking the activity of the receptor for the angiotensin converting enzyme 2 (ACE2) of SARS-CoV-2 have shown that the constituents of some essential oils can potentiate conventional antiviral agents and thus relieve the symptoms of COVID-19 as is the case for limonene, p-cymene and γ -terpinene [5,7], while other constituents even inhibited the ACE2 receptor for SARS-CoV-2 [8]. Hence the idea that our essential oil extracted from A.herba-alba Asso. may have antiviral activity on SARS-CoV-2. If essential oils and their constituents had activities against human pathogenic viruses. So necessarily, the total essential oil of A.herba-alba Asso., One or all of its constituents could be potential antiviral agents against SARS-CoV-2. In addition, it could then be used as an antiviral drug alone, as a potentiator of another conventional antiviral drug or at least as a dietary supplement to relieve symptoms or strengthen the immune system of affected patients, or even its use as an adjuvant in solutions hydro-alcoholic or hydro-alcoholic gels to increase their effectiveness in the external fight against COVID-19.

Clinical studies are needed to assess the efficacy and safety and to provide clinical evidence for traditional medicine. Integrating traditional medicine into conventional treatment could be an alternative approach for the treatment of COVID-19 in the future.

4. CONCLUSION

This study revealed the chemical composition of the essential oils of A. Herba-alba Asso from the Tafengoul locality of Taroudant in Morocco. The sample had a chemical composition similar to that published for A. herba-alba oils from different countries but had an original chemical composition. Indeed, the composition of the essential oil of wild A. Herba-alba indicates that the oil belongs to the chrysanthenone / camphor / thujones / 1,8-cineole chemotype, so rich in oxygenated monoterpenes which have demonstrated in previous studies their antifungal, antibacterial and antiviral properties. However, toxicological and clinical studies are needed to prove the safety of the oil as a drug. Hence the idea of proposing the plant for scientific purposes as a potential source of antiviral molecules against COVID-19.

References:


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