

# Using Traditional Medicinal Plants from Arid and Desert Rangelands as a Potential Treatment for Covid-19 in Southern Tunisia

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## ABSTRACT

Rangelands provide good services, including forage for livestock, aromatic and medicinal plants, wildlife habitat, fuel wood, and the watershed. In the arid and desert rangelands of Tunisia, several medicinal plants are used locally in traditional medicine. Many of them have been scientifically investigated and validated. This study aimed to document the different plants used recently to treat and prevent Covid-19 by the rural communities in southern Tunisia. One hundred persons that were ensured to be cured after their infection by Covid-19 were asked to indicate what plants were used to prevent or treat the pandemic disease. It is noteworthy that the selected respondents did not use any other medication than medicinal plants due to the high price of medicament. Additionally, they had not received any Covid-19 vaccinations to date. Five species were harvested from the range lands to be used by the rural population in south Tunisia to treat and prevent Covid-19. The plants included *Rosmarinus officinalis*, *Thymbra capitata*, *Peganum harmala*, *Artemisia herba-alba* and *Astragalus armatus*. These species are medicinally essential when it comes to treating several human diseases. Still, there are no new scientific findings on whether these conclusions are valid. These results can still be the subject of future scientific research.

**Key words:** folk medicine, coronavirus, cure, global pandemic

## INTRODUCTION

Native range lands are an important source of rare and environmentally, economically, nutritionally, and medically valued plants around the globe. In recent decades, increased attention has been paid to the potential of wild plants in terms of medicinal uses. In many regions of the world, most medicinal plants grow in natural range lands rather than being planted<sup>1</sup>. In China, for example, it is estimated that 80% of medicinal plants are provided by the natural resources<sup>2,3</sup>. In addition, it is estimated that 80% of the world population uses herbal medicine as part of its primary health care, with about 12 % being from South Asia<sup>4</sup>. Given the importance of plants in medicine, the Sri Lankan Government established the Ministry of Indigenous Medicine in 1980 due to the high demand for the drugs based on plants<sup>5</sup>.

The arid environment is also one of diversity in terms of medicinal herbs and it is home to a large number of unique species<sup>6</sup>. Despite being under threat from various biotic and abiotic stresses, many arid range lands still produce medicinal plants that are valued in both traditional and modern medicine. Their harvesting greatly contributes to the annual livelihood income of many populations<sup>7-9</sup>. The excessive

and unsustainable collection of medicinal plants on a large scale from the range lands contributes to rangeland degradation and the extinction of some plant species<sup>10</sup>.

Tunisia's rangelands occupy about 5.5 million ha, of which 87% of them are arid<sup>11</sup>. These lands form the largest part of the Tataouine governorate surface, making up about 27% of the total rangeland in Tunisia<sup>12</sup>. Despite these harsh environments, arid rangelands are blessed with a wide diversity of medicinal plants due to their diverse ecological habitats<sup>13-15</sup>. An ethnobotanical survey conducted of a local community in Tataouine reported that 70 plant species are used for therapeutic purposes<sup>16</sup>. Through the floristic surveys conducted by Gamoun and Louhaichi<sup>12</sup>, a total of 279 species were recorded in the rangelands of Tataouine, and 35 of them were found to be greatly used in both traditional and modern medicine.

Given the spread of diseases, medicinal plants are gaining attention in the context of traditional use. Recently, more than 199 million infections with at least 4 million Covid-19 associated deaths were reported by July 2021<sup>17</sup>.

Tunisia is among the countries most severely affected by the ongoing pandemic, with more than 560 thou-

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## History

- Received: Sep 06, 2021
- Accepted: Sep 10, 2021
- Published: Oct 01, 2021

DOI : 10.15419/ajhs.v7i2.491



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**Cite this article :** Gamoun M. Using Traditional Medicinal Plants from Arid and Desert Rangelands as a Potential Treatment for Covid-19 in Southern Tunisia. *Asian J. Health Sci.*, 2021; 7(2):21.

sand infections and at least 18 thousand deaths reported by July 2021<sup>17</sup>. In light of the Covid-19 pandemic, the fragile health care system, and the lack of infrastructure, the use of medicinal plants has acquired a renewed interest by the rural population of Tunisia. The present study has therefore attempted to reveal some of the medicinal plants used in the south of Tunisia to prevent or treat Covid-19 infection.

## METHODOLOGY

Tataouine is located in the south of Tunisia, totaling 150 thousand inhabitants. It recorded close to 10,500 coronavirus cases and 410 deaths by the end of July 2021<sup>18</sup>. Due to this record of infection, the slow pace of vaccination in Tunisia, and the mistrust in the available Covid-19 vaccines held by some people, the community has become increasingly disappointed. This has led them to using native plants which may help them to address the current pandemic. In July 2021, 100 persons that were cured of Covid-19 were asked to indicate what plants were used to prevent or treat the disease. It is noteworthy that the selected respondents did not use any medication other than the medicinal plants due to the high price of medication and that they had not received any Covid-19 vaccinations to date.

## RESULTS AND DISCUSSION

Botanical studies conducted in the arid and desert rangeland of Tataouine have identified a rich collection of over 270 plants from 58 families<sup>11,12</sup>, where 65% of the family contributions are from Asteraceae, Poaceae, Fabaceae, Amaranthaceae, Brassicaceae, Boraginaceae, Caryophyllaceae, Lamiaceae, Apiaceae, and Cistaceae. The rangeland is botanically endowed with rich and diverse medicinal plants where 35 plant species belonging to 15 families are greatly used in both traditional and modern medicine. Lamiaceae and Apiaceae were found to occur in the highest proportion for medicinal use. The families with the highest number of species were Lamiaceae with 6 species, Apiaceae with 4, Amaryllidaceae, Amaranthaceae, Asteraceae, Brassicaceae, Amaryllidaceae, Ephedraceae, Fabaceae, Nitrariaceae, Poaceae, Polygonaceae, Ephedraceae, Fabaceae, Nitrariaceae, Poaceae, Polygonaceae with 2 species each, and Apocynaceae, Capparaceae, Caryophyllaceae, Cucurbitaceae, Rhamnaceae, Thymelaeaceae, Zygophyllaceae with a single species each.

Five species were harvested from the rangelands and used by the local community to treat and prevent Covid-19 (Table 1). These included *Rosmarinus officinalis*, *Thymbra capitata*, *Peganum harmala*, *Artemisia herba-alba* and *Astragalus armatus*.

The most important species in terms of the number of users was *R. officinalis*, used by 47 people. In addition, *T. capitata* was used by 25 people, followed by *P. harmala* by 19 people, *A. herba-alba* by 16 and *A. armatus* by 12 people. Some of the respondents used pairs of species at a time. Of the 100 interviewed, 12 people used *R. officinalis* and *T. capitata*, 5 people used *P. harmala* and *A. herba-alba* and 2 people used *A. armatus* and *A. herba alba*.

***Rosmarinus officinalis* L.** is a perennial shrub native to the Mediterranean basin belonging to Lamiaceae family (Figure 1). It is more commonly known as rosemary and “*Ikli*” in classical Arabic. It has multiple uses including medicinal, aromatic, and ornamental<sup>19</sup>. *R. officinalis* as an essential oil has important inflammatory<sup>20-23</sup>, antimutagenic<sup>24,25</sup>, cytotoxic<sup>26-28</sup>, antiphlogistic<sup>24,29</sup>, analgesic<sup>30-32</sup>, anti-obesity<sup>33</sup> and hepatoprotective applications<sup>34,35</sup>, as well as being used in the prevention and treatment of diabetic and cardiovascular diseases<sup>36</sup>. It is also well known for its biological active essential oils that are antioxidants<sup>37-39</sup>, anticancer<sup>28,40,41</sup>, antibacterial<sup>42,43</sup>, and antifungal<sup>44-46</sup>. Moreover, *R. officinalis* is a pulmonary antiseptic, as well as stomachic, hypertensive, and antidiarrheal due to its diuretic and sudorific qualities<sup>15</sup>.

The leaves of *R. officinalis* were the most used plant part by the local people in the treatment of Covid-19. They boiled the dried rosemary leaves in water and drank it once it had cooled.

***Thymbra capitata* (L.) Cav.**, is a perennial herbaceous shrub native to the Mediterranean area, belonging to Lamiaceae family (Figure 2). It is commonly known as thyme and it is locally known as “*Zaatar horr*”. In southern Tunisia, it is represented by scattered populations on sandy and often rocky soils. *T. capitata* is known for the effectiveness of its essential oil as part of a local utilization for traditional medicinal purposes. It is widely used for folk medicinal purposes to treat arterial hypertension, ulcers, colic, digestive and respiratory system disorders, and diarrhea<sup>47,48</sup>. Nowadays, the essential oil of *T. capitata* is gaining interest due its potential biological properties<sup>49,50</sup>. It is mainly known for being an antioxidant<sup>51</sup>, anti-inflammatory<sup>52,53</sup>, antimicrobial<sup>54-56</sup>, cytotoxic<sup>57,58</sup>, antimycotic<sup>59,60</sup>, anticancer<sup>61</sup>, antiproliferative<sup>62</sup>, and antifungal<sup>63</sup>. These main biological activities were reported to be

**Table 1: Traditional medicinal plants used by local population in the south of Tunisia against Covid-19**

Plant species	Common name	Part used	Indication
<i>R. officinalis</i>	Rosemary	Leaves	Boiling dried leaves of rosemary in water and drank when it cools.
<i>T. capitata</i>	Conehead thyme	Leaves	Boiling dried leaves of <i>T. capitata</i> in water and drank when it cools. To treat coughs, fever, and bronchitis, leaf powder is mixed with honey and applied to the chest.
<i>P. harmala</i>	Wild rue	Stems, leaves and seeds	Wild rue smoke efficacy against Covid-19: putting leaves, seeds, stems, on hot coals, and breathe the smoke through the nose, and it will cause all rheum to go away. Fumigate the home to prevent the spread of all kinds of infectious diseases.
<i>A. herba-alba</i>	White worm-wood	Leaves	Putting the leaves of <i>A. herba-alba</i> on hot coals, and breathes the smoke through the nose, and it will cause all rheum to go away.
<i>A. armatus</i>	Milkvetch	Roots	Decoction of roots of <i>A. armatus</i> is orally taken to treat and prevent Covid-19, because it can stimulate the immune system and act against viruses like the ones that cause colds.



**Figure 1: Rosmarinus officinalis L.**



**Figure 2: Thymra capitata (L.) Cav.**





**Figure 3:** *Peganum harmala* L.



**Figure 4:** *Artemisia herba-alba* Asso.



**Figure 5:** *Astragalus armatus* Willd.

due to its richness of phenolic compounds in the extracted essential oils<sup>64-66</sup>.

The leaves of *Thymbra capitata* were found to be the plant part used the most by the local people in their treatment of Covid-19. They boiled the dried leaves of *T. capitata* in water and drank the mixture when it cooled. Likewise, the leaf powder was also mixed with honey and applied to the chest to treat coughs, a fever, and bronchitis.

***Peganum harmala* L.** is a herbaceous perennial flowering plant that is widely distributed in Central Asia, North Africa, and the Middle East (Figure 3). It is commonly known as African rue, Syrian rue, and wild rue. This plant, known as *harmal* in North Africa, belongs to the Nitrariaceae family. *Peganum harmala* is a noxious invasive species. It is toxic to livestock when fresh but medicinally important<sup>67</sup>. The seeds are known to possess hypothermic properties<sup>68,69</sup> and it is effective in the treatment of dermatosis<sup>70</sup>. Furthermore, *P. harmala* was shown to possess lactagogue, antihelminthic, antispasmodic, abortifient, antipyretic, emetic, emmenagogue, cardiovascular, neurologic, antimicrobial, gastrointestinal, anticancer, and antidiabetic activities<sup>71</sup>. It has also been found that *P. harmala* has insecticidal and anti-tumor effects<sup>72</sup>, as well as being antileishmanial<sup>73</sup>, anti-spasmodic, anti-malaria<sup>72</sup>, vasorelaxant and anti-histaminic<sup>74</sup>. This is as well as promoting wound healing, antioxidant activity, immunomodulator properties, and leukemia healing<sup>75</sup> with analgesic and anti-inflammatory properties. Finally, it also has antinociceptive<sup>76</sup>, hepatoprotective<sup>77</sup>, hypoglycemic, antitumor<sup>78</sup>, cytotoxic, antifungal, antibacterial and antiviral effects<sup>79</sup>.

To treat and prevent Covid-19, the local community takes any part of *P. harmala* (leaves, seeds, stems, roots) and puts it on hot coals. They breathe in the smoke through the nose. This causes all of the rheum to go away.

***Artemisia herba-alba* Asso.**, is a perennial shrub belonging to the Asteraceae family. It is commonly known as white wormwood and it is locally known as “*Chih*.” (Figure 4). It is widespread in the arid and semi-arid steppes of North Africa, South-western Europe, and the Middle East. Since ancient times, *A. herba-alba* has been extensively used in traditional medicine to treat hypertension, scorpion/snake bites, diabetes, colds, parasitic infections, intestinal disturbances, bronchitis, diarrhea, neuralgias, stomach pains, and hemorrhoids<sup>16,80-83</sup>. It is known for its antioxidant, anticancer, antimicrobial, anti-inflammatory, genotoxic, cytotoxic, antiacetylcholinesterase, and fungicidal activities<sup>84-88</sup>.

To treat and prevent Covid-19, the local community takes the leaves of *A. herba-alba* and puts them on hot coals. They breathe in the smoke through the nose, and this causes all of the rheum to go away.

***Astragalus armatus* Willd.** is a perennial spiny shrub native to Algeria, Libya, Morocco, and Tunisia. It is commonly known as thorny milkvetch and it is locally known as “*Guetet*” (Figure 5). *Astragalus armatus* has been used in traditional medicine as an effective treatment for leishmaniasis and helminthiasis<sup>89</sup>. It also relieves odontonecrosis<sup>16</sup>. Nowadays, pods of *Astragalus armatus* are receiving interest due to their potential antioxidant, anticholinesterase, antibacterial and phagocytic activities<sup>90</sup>. They are also a source of the bioactive galactomannan<sup>91</sup>. The genus *Astragalus* (*Astragalus membranaceus*; *Astragalus mongholicus*) is used to prevent colds and upper respiratory infections, to protect and support the immune system, to protect the liver, to decrease blood pressure, and to cure diabetes<sup>92,93</sup>.

A water decoction of roots of *A. armatus* is orally taken to treat and prevent Covid-19 because it can stimulate the immune system, helping it to fight against viruses like the ones that cause colds.

Fear used to grip the country. This seemed clear before the vaccine became available sufficiently. The intensification of the fourth wave of coronavirus has killed thousands of people. In this changing epidemiological situation, people have resorted to looking to plants to boost their immunity. Among the most used species, there are those that have been mentioned above such as *R. officinalis*, *T. capitata*, *P. harmala*, *A. herba-alba*, and *A. armatus*. Some native species have been traditionally valued for warding off winter flu, which shares some symptoms with the new coronavirus.

Recent studies have shown that *R. officinalis* and *T. capitata* have been used by Tunisian and Moroccan Covid-19 patients due to their antiviral properties and the presence of various complex chemical substances that may play an important role in the inhibition of Covid-19<sup>94,95</sup>. *R. officinalis* has a potential role, due to its natural antiviral compounds, in the development of plant-based drugs to use against coronavirus<sup>96,97</sup>. *In vitro* evidence shows that a mixture of essential oils from three Cretan Aromatic Plants (*Thymbra capitata* (L.) Cav., *Salvia fruticosa* Mill. and *Origanum dictamnus* L.) inhibits SARS-CoV-2 proliferation. This may be a valuable addition for the prevention and/or treatment of mild Covid-19<sup>98</sup>. The positive effects of *P. harmala* against several viruses have been proven through *in vitro* experiments including SARS-CoV-2 and influenza virus, both of

which have indications similar to Covid-19. This means that it is likely to be effective in the treatment of Covid-19<sup>99,100</sup>. Asdadi *et al.*<sup>101</sup> and Attah *et al.*<sup>102</sup> suggested that *A. herba-alba* has possible potential against Covid-19 due to its antiviral activities. *A. armatus* is used to treat several human diseases but there is no good scientific evidence to support its efficacy against Covid-19, although it may have some antiviral activity. Some *Astragalus* species, such as *Astragalus membranaceus*, have been used in traditional Chinese Medicine in the treatment of Covid-19<sup>103</sup>. From these results, supported by other research findings and databases, we suggest that these species have potential against Covid-19 but more scientific research is required to validate their validity.

## CONCLUSION

Today, the world faces an ongoing Covid-19 pandemic. This pandemic has become a significant challenge when it comes to human security. Tunisia, like every country in the world, is facing the Covid-19 pandemic and the many connected challenges that it has caused. Due to the increased price of the cost of medication and medical supplies and the projected increase in the incidence of Covid-19, the use of medicinal plants has grown rapidly among rural populations. The arid and desert range lands of Tunisia provide a habitat for several medicinal plants used in traditional medicine that are used to prevent and treat Covid-19 such as *Rosmarinus officinalis*, *Thymbra capitata*, *Peganum harmala*, *Artemisia herba-alba*, and *Astragalus armatus*. However, harvesting shrubs for fuel wood and overgrazing is threatening the flora biodiversity found in these range lands and the lives of the people who live there. This calls for urgent action.

## ABBREVIATIONS

None.

## ACKNOWLEDGMENTS

The author would like to thank all the participants who entirely voluntarily participated in this study for providing their detailed and thoughtful responses.

## AUTHOR'S CONTRIBUTIONS

None

## FUNDING

None

## AVAILABILITY OF DATA AND MATERIALS

Data and materials used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

## CONSENT FOR PUBLICATION

Not applicable.

## COMPETING INTERESTS

The authors declare that they have no competing interests.

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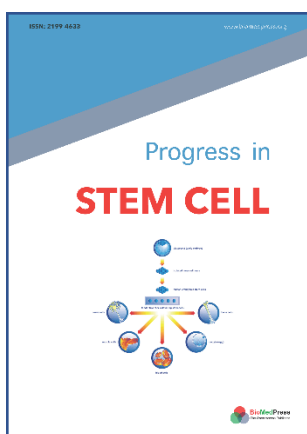
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