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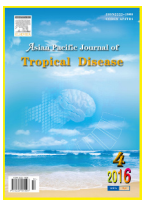

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Phytochemical, organoleptic and ferric reducing properties of essential oil and ethanolic extract from *Pistacia lentiscus* (L.)

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ABSTRACT

Objective: To study the phytochemical composition and organoleptic properties of *Pistacia lentiscus* (L.) (*P. lentiscus*) from Algeria and to investigate the antioxidant activities of its essential oil and ethanolic extract.

Methods: Aerial parts of *P. lentiscus* were collected at Hammam Melouane (Blida), 50 km from Algiers. Different solvent extractions were made for the preliminary screening of phytochemicals. Additionally, the physicochemical and organoleptic properties of the Algerian variety have been characterized. Moreover, *P. lentiscus* essential oil and ethanolic extract were studied for their antioxidant potential by ferric reducing power test.

Results: Phytochemical screening of *P. lentiscus* revealed the presence of various biochemicals, including leuco-anthocyanins, condensed tannins, gallic tannins, saponoside, coumarins, and flavonoids, while others were absent (anthocyanins and alcaloids). Essential oil showed lower antioxidant potential compared to the ethanolic extract, reflecting the potential phenolic content responsible for this activity.

Conclusions: The present study reveals the presence of various phytochemical classes in *P. lentiscus*, and the antioxidant experiment shows a good bioactivity of the aerial parts of the Algerian *P. lentiscus*. The literature review of the essential oil composition shows also important variations due to geographic and environmental conditions. This preliminary investigation will help explore the bioactive compounds of *P. lentiscus*, and will bring data for a better physicochemical and organoleptic classification of the Algerian variety.

1. Introduction

The oxidation is one of the most important mechanisms for producing free radicals in food, drugs and even physiological systems[1,2]. Reactive oxygen species may be the causative factor involved in many human degenerative diseases, and antioxidant compounds are known to have some degrees of preventive and therapeutic effects on these disorders[3]. Antioxidant supplements in foods may be used to help the human body reduce oxidative damage caused by free radicals[4]. It is well-known that oxidation damages various biological substances and subsequently causes many diseases. Accordingly, there are many research papers on the relationships between oxidative damages and various diseases including cancer[5], aging[6], inflammation[7], diabetes[8,9] and atherosclerosis[10]. Recently, the interest in natural antioxidants, in relation to their therapeutic properties, has increased dramatically. For these reasons, many extractions, identification and quantification methods have been developed[11,12].

The antioxidant activity of a compound is defined as the ability to scavenge or inhibit oxidation radicals. Major antioxidants are the ascorbic acid (vitamin C), tocopherol (vitamin E) as well as

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phenolic compounds. Indeed, most synthetic or naturally occurring antioxidants have phenolic hydroxyl groups in their structures, and antioxidant properties are attributed in part to the ability of these natural compounds to scavenge free radicals such as hydroxyl radicals ($OH^{\bullet}$) and superoxide ($O_2^{\bullet}$)[13,14].

Several methods are used to evaluate *in vitro* and *in vivo* antioxidant activity by scavenging different radicals by the oxygen radical absorbance capacity and total radical-trapping antioxidant parameter methods[15]; ferric ions by ferric ion reducing antioxidant parameter method[16]; or the method using radical ABTS$^{\bullet}$ (ammonium salt of 2,2'-azinobis-3-ethylbenzothiazoline-6-sulfonic acid)[17] and the free radical DPPH$^{\bullet}$ (diphenyl-picrylhydrazyl)[18].

Given the complexity of diversified oxidation process and the nature of the antioxidants, with components both hydrophilic and hydrophobic, there is no universal method by which the antioxidant activity can be quantitatively measured in a precise manner. Most often it is necessary to combine the responses of different and complementary tests to get an indication of the antioxidant capacity of the test sample[19,20].

Pistacia is a particular genus of the Anacardiaceae family. *Pistacia lentiscus* (L.) (*P. lentiscus*) is a Mediterranean herb that develops on any soil type[21]. The essential oil of *P. lentiscus* is often used as a remedy to treat burns[22] and back pain[23]. The aim of this work was to evaluate the antioxidant properties of the essential oil and ethanolic extract of the Algerian *P. lentiscus*.

2. Materials and methods

2.1. Plant material

P. lentiscus (Figure 1) was collected by the end of February at Hammam Melouane (Blida), at 950 m of altitude, 50 km from Algiers (36°27' N and 2°52' E). The region is characterized by sub-humid climate and siliceous soil. The collection was carried out under the best possible conditions, avoiding dew, rain or excessive moisture. The freshly harvested plant was allowed to dry in the open air in the laboratory at an ambient temperature. After drying, the aerial part was ground with a mechanical mixer to obtain a fine powder in order to prepare the extracts. The plant material was identified at the Faculty of Natural Sciences and Life, University Saad Dahleb Blida 1, Algeria by Dr. Belkhoussa Samir.

2.2. Determination of water content

The loss rate during drying (water and the volatile matter content) was determined using 1 g of aliquot of the sample cut into small pieces in a porcelain dish, and dried in an oven set at a temperature of (103 ± 2) ℃ for 2 h up to a constant weight according to the European Pharmacopoeia[24]. The operation is repeated until a constant weight (by reducing the drying lasted 30 min) to prevent the caramelization.

The water content is determined using the following formula:

$$H\ (\%) = \frac{M1 - M2}{P} \times 100$$

where, H (%) is humidity percentage; M1 is the mass of the capsule and the fresh material before drying (g); M2 is the mass of the capsule and the fresh material after drying (g); P is the mass of sample tested (g).

Figure 1. *P. lentiscus*.

2.3. Determination of ash content

The *P. lentiscus* was cut into small pieces and then calcined at 550 ℃ in a muffle furnace until obtaining a constant weight of white ash[24].

In porcelain capsules, 2 g of *P. lentiscus* was weighed and cut into small pieces; then the capsules were placed in a muffle furnace set at (550 ± 15) ℃ for 5 h until a gray, clear or whitish matter was obtained, and the matter was put in the dryer to cool and then weighed.

The ash content was determined according to the following formula:

$$MO\ (\%) = \frac{M1 - M2}{P} \times 100$$

where, MO (%) means percentage of organic matter; M1 means a mass of the test portion + capsules; M2 means a mass of capsules + ashes; P means mass of the sample tested.

The ash content (Cd) was calculated by using the formula:

$$Cd = 100 - MO\ (\%)$$

2.4. Ethanolic extract preparation

The ethanolic extract was obtained by using the Soxhlet method, which enables a solid-liquid extraction with a high efficiency. The dried whole plant was crushed and reduced to a fine powder; 40 g of the powder obtained was mixed with 400 mL of a solvent (ethanol) in a reflux condenser for 6 h. After extraction, the solvent-rich substance extracted was recovered in a ball, and then passed to the rotary apparatus to evaporate the solvent then lyophilized. The extract thus obtained was placed in a desiccator, weighed and stored at 5 ℃.

2.5. Essential oil preparation

The extraction of essential oil from the aerial part of *P. lentiscus*