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Chemical Composition and Antioxidant Potential of *Pistacia lentiscus* L. Essential Oil from Oran (Algeria)

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Abstract

Essential oil from the leaves of *Pistacia lentiscus* L. growing in the Oran region in the west of Algeria was obtained by hydrodistillation with a 1.26 % yield on a dry weight basis. Spectrophotometric analyses were employed to highlight the scavenger capacity of this oil using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) test. Twenty compounds were identified by GC and CG/MS analyses, and the main part of the compounds of the oil was terpinene-4-ol (41.24%) and α-terpineol (7.31%), α-pinene (9.48%), limonene (09.11%), β-myrcene (10.5%), p-cymene (8.67%) and α-phellandrene (2.20%), β-caryophyllene (12.62%) as major compounds. The DPPH test shows that *Pistacia lentiscus* essential oil possesses antiradical activity. A linear correlation (correlation coefficient $R^2 = 0.995$, $P < 0.001$) was found between the reduction of DPPH stable free radical and the concentration of *Pistacia lentiscus* essential oil.

Keywords

Pistacia lentiscus, Terpinene-4-ol, Essential Oil, Antioxidant Activity

1. Introduction

Pistacia lentiscus L. is an aromatic member of the Anacardiaceae family. In Algeria, *P. lentiscus* L. occurs in various regions, the aerial parts of *P. lentiscus* L. has traditionally been used against several diseases [1]. Mastic gum from *Pistacia* has been used by folkloric medicine for the relief of upper abdominal discomfort, stomachaches, dyspepsia and peptic ulcer [2].

Several biological activities have been attributed to the essential oil from aerial parts of *P. lentiscus* L. such as their antifungal, antibacterial an antimicrobial effect [3] [4] [5].

Some works reported the chemical composition of the essential oil from aerial parts of *P. lentiscus* L. of diverse countries of the Mediterranean region [6]-[20]. The chemical composition of the essential oil derived from the aerial parts is not clear; it is greatly influenced by both geographical origin and isolation technique.

The aim of this work was to evaluate antioxidant activities of the essential oil from aerial parts of *P. lentiscus* L from the region of Oran (Algeria), in relation with the composition of their compounds.

2. Materials and Methods

2.1. Plant Material

Leaves of *Pistacia lentiscus* of the region of Oran were collected in June 2015, during the period of full flowering. Voucher specimens were identified and deposited in the herbarium of the Agricultural Institute in Algeries, Algeria.

2.2. Isolation of the Essential Oil

The air-dried plant material (80 g), both leaves and flowers, was hydrodistilled in an all-glass apparatus according to the method recommended by the European Pharmacopoeia [21]. The essential oil obtained was dried over anhydrous sodium sulfate. Yield based on dry weight of the sample was 1.26%.

2.3. GC

Analytical GC was carried out on a Varian (Palo Alto, CA) model 3300 gas chromatograph fitted with a fused silica MFE1 capillary column (50 m × 0.25 mm, film thickness 0.25 μm), with N_2 as the carrier gas at a flow rate of 1.5 mL/minute, in split mode, with the temperature programmed to rise from 95˚C to 240˚C at 4˚C/minute. The injector temperature was 250˚C, the detector used was a flame ionization detector, and the detector temperature was 300˚C. Injection volume for all samples was 0.1 μl.

2.4. GC/MS

Analyses were carried out on an Agilent (Palo Alto) 6890 gas chromatograph fitted with a fused Agilent 19091S-433 HP-5MS column (30.0 m × 0.25 mm; film thickness 0.30 μm; temperature programmed from 40˚C to 280˚C at 4˚C/minute) with He as the carrier gas at a flow rate of 1 ml/minute. The chromatograph was coupled to an HP 5973 A mass spectrometer (Hewlett Packard, Palo Alto).

2.5. Identification of Components

Most constituents were identified by means of GC/MS. Some components were tentatively identified by comparing their retention indices on both chromatographic columns with those of authentic compounds and with literature data [22] [23].

2.6. Antioxidant Test Free Radical Scavenging Activity (DPPH) Method

The antioxidant activity was measured by a modification of the DPPH radical scaveng-

ing method of Ramos *et al.* [24] Two hundred microliters of distilled water was mixed with 160 µL of DPPH (0.5 mM in ethanol), and then 40-L samples of the oil in ethanol (ranging from 2.50 to 20 µL/mL) were added. The mixture was shaken and left to stand at room temperature. The absorbance (*A*) was measured 30 minutes later at 517 nm.

The inhibition potential (IP) (as a percentage) is measured using the formula:

$$IP=\left(A_{DPPH}-A_{sample}/A_{DPPH}\right).$$

2.7. Statistical Analysis

All *evaluations* of antioxidant activity were performed twice. The experimental data were expressed as means ± standard deviation (S.D). The correlation coefficient of antioxidant activity was determined using Excel programme and Origin 6.

3. Results

Hydrodistillation of dried leaves of *P. lentiscus* yielded 1.26%. Twenty compounds, representing 97.63% of the oil, were identified. Results of the qualitative determination of the different constituents, together with those of the quantitative analysis are compiled in Table 1. The main compounds were oxygenated monoterpenes, characterized by the great prevalence of terpinene-4-ol (41.24%) and *α*-terpineol (7.31%), *α*-pinene (9.48%), limonene (09.11%), *β*-myrcene (10.5 %), *p*-cymene (8.67 %) and *α*-phel-landrene (2.20%), *β*-caryophyllene (22.62%) as major compounds.

As shown in Figure 1, the *P. lentiscus* essential oil reduced the stable free radical DPPH in a concentration-dependent manner. The relationship between the antiradical activity and the concentration of *Pistacia lentiscus* essential oil (Figure 1) was positive and significant (R^2 = 0.995, P <0.001).

The extract concentration producing 50% inhibition was calculated (Figure 1); it represents 0.39 mg/ml, corresponding to 0.05 mg/mL ascorbic acid (data not shown).

4. Discussion

These results show that *Pistacia lentiscus* is rich in oxygenated monoterpene.

To the best of our knowledge this work is therefore the first report on the essential oil of *Pistacia lentiscus* from Oran Algeria.

In other countries of the Mediterranean region, several studies have been studied the chemical composition of *P. lentiscus* L. oil [6]-[20] and several compositions were observed. Myrcene (39.2%), which is the major compounds of our essential oil, has also the abundant compound in the samples from Morocco (38%) [4], France (76.9%) [6], Spain (27%) [7], Italy (25.2%) [8] and Algeria (23.0% - 33.1%) [9].

On the other hand, *α*-pinene was the major compound of the essential oils from Morocco (16.1% - 38.5%) [10], Algeria (20.0% - 34.2% and 19%) [9] [19], Tunisia (16.8%) [11], Greece (24.9% - 9.4%) [12], Italy (14.8% - 22.6% and 18%) [13] [14], Spain (13.0%) [15] and France (31.9%) [6].

In our study terpinene-4-ol was by far the major component (41.24%) accompanied

Table 1. Percentage of essential oil composition of *P. lentiscus*.

Peak number	*Compound*	Kovats index	Percentage (%)
1	*α*-pinene	928	**9.48**
2	*β*-Myrcene	948	0.9
3	*α*-phellandrene	964	2.20
4	*β*-pinene	966	t
5	Cis-ocimene	976	t
6	Unknow	998	-
7	3-carene	1005	0.8
8	*δ*-Carene	1012	t
8	Limonene	1018	09.11
9	p-Cymene	1028	8.67
10	p-cymen-8-ol	1042	t
11	Terpinolene	1052	t
12	Linalool	1082	1.4
13	Verbenol	1122	0.7
14	Terpinene-4-ol	1137	41.24
15	Borneol	1138	0.8
16	*α*-terpineol	1174	7.31
17	2-Undecanone	1290	0.7
18	Isoledene	1419	0.9
19	Unknow	1458	-
20	*β*-caryophyllene	1494	12.62
22	Globulol	1530	0.8

Components are arranged in order of MFE1 elution, t: trace percentage (%) ≤ 0.6.

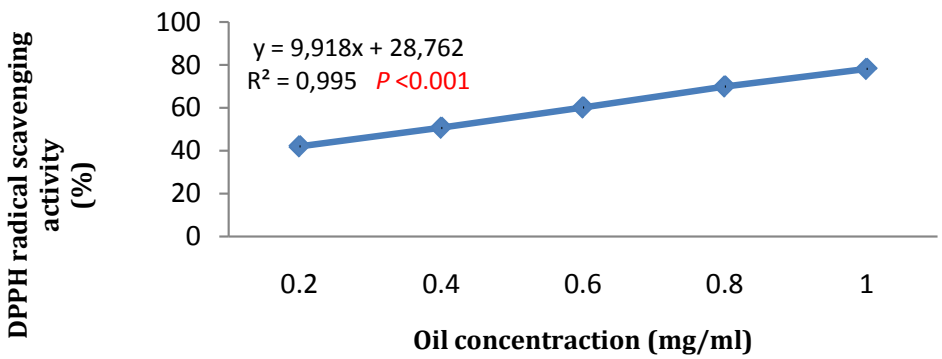

Figure 1. Positive correlation between the reduction of DPPH stable radical and the concentration of *Pistacia lentiscus* essential oil.

by limonene (09.11%), β-myrcene (10.5 %) and β-caryophyllene (12.62%). it is worth noting that this oil is the richest source of naturally occurring terpinene-4-o that has been found.

Besides, terpinen-4-ol was mainly present in the oils from Morocco (14.5% - 19.3%) [10], Algeria (17.3% - 34.7%) [16], Turkey (30.0% and 29.2%) [17] [18], and France (25.6%) [6]. Other chemotypes were also reported: longifolene (16.4% - 12.8% Algeria) [19] limonene (47.0% France and 44% - 29% Algeria) [6] [9]; β-caryophellene (19.3% - 13.1% Algeria [9] and 31.5% Italy [20].

The antioxidant activity of *Pistacia lentiscus* essential oil may provide a protective effect from oxidative stress-related diseases.

As a result, the antioxidant activity of the essential oil was generally ascribed to the terpenes.

5. Conclusion

In conclusion, essential oil from *Pistacia lentiscus* and its components generally displayed strong antioxidant properties, which are useful in daily life in foods and as preventive agents against various diseases.

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