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GC-MS ANALYSIS OF THE ESSENTIAL OIL FROM THE OLEORESIN OF *Pistacia atlantica* VAR. *mutica*

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The oleoresin of Pistacia atlantica *var.* mutica, *growing in different regions of Iran, is a popular naturally occurring chewing gum and has been used traditionally in the treatment of peptic ulcer. The GC-MS analysis of the essential oil, obtained from steam distillation of the oleoresin of* P. atlantica *var.* mutica, *has led to the identification and quantification of eleven terpenoids,* α*-pinene (70%),* β*-pinene (1.94%), 3-carene (0.2%), carveol (2.18%), epoxypinene (2.15%), limonene oxide (9%), myrtenol (5.31%), limonene (0.62%), citral (5.72%),* α*-phellandrene (0.2%), and* β*-myrcene (0.3%). The total amount of essential oil obtained was 22% v/w which is higher than any other species of the genus* Pestacia.

Key words: *Pistacia atlantica* var. *mutica*, essential oil, oleoresisn, GC-MS.

The genus *Pistacia* L. (family: Anacardiaceae *alt.* Pistaciaceae) consists of *ca.* 11 species, most of which are known to produce oleoresin [1]. Among them *P. lentiscus* var. *Chia* and *P. atlantica* are the main oleoresin producing species and of immense economic and pharmaceutical importance [1]. Oleoresin of *P. lentiscus* possesses anti-*Heliocobacter pylori* activity and can be beneficial in the treatment of peptic ulcer [2–5]. The essential oil of this oleoresin is also used in cosmetics and perfumery, and as a flavoring agent in food preparations [3]. *Pistacia atlantica* Desf. var. *mutica* (Fisch. et. C. A. Mey) Rech. f. is native to a number of countries of temperate Asia, e.g. Armenia, Azerbaijan, Iran, Iraq, Turkey, etc. [6]. In Iran, this plant grows in the central, western, and eastern regions. The oleoresin of *P. atlantica* var. *mutica*, known as "Turk terebinth gum," is used to make chewing gum in Iran. This plant has also been used traditionally in the treatment of peptic ulcer and as a mouth freshener [7]. Previous phytochemical investigation of the oil of *P. atlantica* fruits revealed the presence of fatty acids and sterols [8]. The presence of α-pinene in the essential oil of this species has recently been reported [9]. However, to our knowledge, comprehensive GC-MS analysis of the essential oil of the oleoresin of *P. atlantica* var. *mutica* leading to the identification of a number of various types of monoterpene derivatives has never been reported before. We now report on the GC-MS analysis of this essential oil.

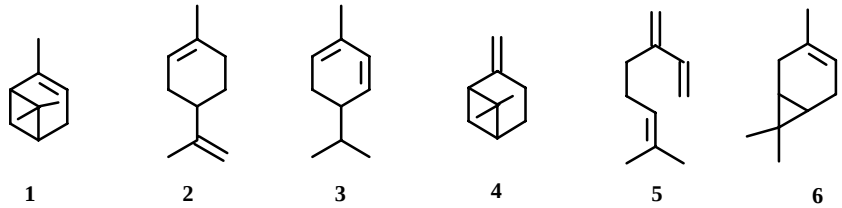

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TABLE 1. Components of the Essential Oil of the Oligoresin of *Pistacia atlantica* var. *mutica* Analyzed by GC-MS

Compounds	Retention time, min	Amount present in oil, %	Molecular ion, m/z (rel. Int.)	Main fragment ions, m/z (rel. Int.)
α-Pinene (**1**)	4.984	70.00	136 (12)	93 (100), 92 (43), 91 (40), 77 (24), 79 (23), 41 (22)
Limonene (**2**)	5.181	0.62	136 (18)	121 (38), 93 (60), 79 (23), 68 (100), 67 (65)
α-Phellandren (**3**)	5.263	0.20	136 (20)	119 (22), 93 (100), 92 (23), 91 (40), 77 (21)
β-Pinene (**4**)	5.843	1.94	136 (11)	93 (100), 79 (23), 77 (21), 69 (36), 41 (38)
β-Myrcene (**5**)	7.170	0.30	136 (2)	93 (100), 91 (26), 79 (39), 69 (41), 67 (16)
3-Carene (**6**)	4.422	0.20	136 (35)	93 (100), 91 (41), 80 (27), 79 (30), 77 (22)
Citral (**7**)	9.582	5.72	152 (2)	94 (22), 84 (24), 69 (100), 53 (12), 41 (95), 39 (22)
Epoxypinene (**8**)	9.962	2.15	152 (4)	109 (31), 108 (100), 95 (40), 93 (78), 91 (30), 67 (42), 55 (37)
Limonene oxide (**9**)	10.895	0.62	152 (8)	109 (82), 81 (80), 79 (57), 67 (100), 55 (42), 43 (90), 41 (55)
Myrtenol (**10**)	12.274	5.31	152 (1)	108 (28, 91 (45), 79 (100), 41 (30), 39 (20)
Carveol (**11**)	12.897	2.18	152 (8)	134 (35), 119 (100), 109 (31), 91 (45), 77 (26), 55 (20)

TABLE 2. Components of Essential Oils of Other *Pistacia* Species

Plant species	Essential oil, %	Components of essential oil, %	References
P. lentiscus	2.0	**1** (64.43-86.38), **5** (5-25.3), **4** (3.29), linalool (2.84), *trans*-caryophyllene (2.04), **2** (1.26), methyl-*o*-cresol (1.17) and camphene	4, 13-15
P. vera	NR	(+)-9,10-Cyclopropylterpinene-4-ol, (+)-9,10-cyclopropylterpinene-2,4-diol, (+)-*trans*-verbenol, (-)-piocarveol and terpinolene	16, 17
P. khinjuk	0.87	**1** (61.13), **5** (8.28), **4** (2.51), ρ-cymene (2.5), **6** (1.36), nonaldehyde and linalool (2.76), β-caryophyllene (1.95), and unquantified 2, 3, α-thujene, camphene, α-fenchene, sabinene, α-phellandrene, cineol, fenchone, borneol and α-terpineil	18
P. terebinthus	NR	**1** (39.6), **4** (19.5), sabinene (6.5), terpinen-4-ol (3.8), and unquantified **6**	19

NR = Not reported yet.

The oleoresin of *Pistacia atlantica* var. *mutica* yielded 22.0% (v/w) of a pale yellowish essential oil with a strong acrid odor. The yield of essential oil from *P. atlantica* var. *mutica* was higher than any other *Pistacia* species reported to date.

The hyphenated technique, GC-MS, is a valuable tool in modern food, medicine, and biological research aiming at the separation and identification of components of organic mixtures, and this method has already been applied successfully for the analysis of terpenoids, especially mono- and sesquiterpenes, in various resins [1]. The GC-MS analysis of the oleoresin of *Pistacia atlantica* var. *mutica* led to the identification and quantification of a total of eleven compounds, accounting for the 97.42% of the total components present (Table 1). By direct comparison of the retention times and mass spectral data of these eleven compounds with those for the respective reference compounds, library matching, and by comparison of the fragmentation patterns of the mass spectra with those reported in the literature, we identified monoterpenes: α-pinene (**1**, 70%), limonene (**2**, 0.62%), α-phellandrene (**3**, 0.2%), β-pinene (**4**, 1.94%), β-myrcene (**5**, 0.3%), 3-carene (**6**, 0.2%); aldehyde citral (**7**, 5.72%); epoxides, epoxypinene (**8**, 2.15%), limonene oxide (**9**, 9%); alcohols, myrtenol (**10**, 5.31%) and carveol (**11**, 2.18%). The mass spectral data of all these compounds (**1–11**) were identical with published data for the respective compounds [10–12], only differing occasionally in the relative intensity of some minor fragments.

Compounds **1–11** could be classified into three classes on the basis of their retention times and chemical structures: non-oxygenated simple of monoterpenes (retention time: 4.09–7.50 min), monoterpene aldehydes and epoxides (retention time: 9.56–10.90 min) and monoterpene alcohols (12.30–12.90 min). The major compound, α-pinene (**1**), found in this plant was also found to be the major constituent of the essential oil of three other species, *P. lentiscus*, *P. khinjuk* and *P. terebinthus*. It

is interesting to note that the chemical profiles of the essential oil of *Pistacia* species vary quite significantly (Table 2).

The oleoresin obtained from *P. atlantica* var. *mutica* has traditionally been used as an antiseptic, in the treatment of peptic ulcer, and to strengthen teeth gum [1, 7]. The presence of high amounts of essential oil in oleoresin of *P. atlantica* var. *mutica* and various biologically active molecules in this oil (**1–11**), especially α-pinene (**1**) which is known to be active against *Helicobacter pylori*, may explain some of the traditional medicinal uses of this species.

EXPERIMENTAL

Plant Material and Oleoresin Preparation. The aerial parts of *P. atlantica* var. *mutica* was collected from Marivan of Kordestan province (situated in Iran) and identified by direct comparison with a herbarium sample. A voucher specimen of this collection has been retained in the School of pharmacy, Tabriz University of Medical Sciences. Oleoresin was collected during May to July 2002.

Extraction of Essential Oil from Oleoresin. The volatile fraction was obtained by steam distillation for 3 h according to the method recommended in the British Pharmacopoeia [10]. The oil was dried over anhydrous sodium sulfate and stored in the refrigerator (4°C).

GC-MS Analysis. The essential oil was analyzed by GC-MS using a Hewlett Packard 5989A mass selective detector coupled with a Hewlett Packard 5890 gas chromatograph, HP-1 capillary column (12 m × 0.2 mm, film thickness 0.32 mm). Operating conditions were as follows: carrier gas, helium with a flow rate of 2 mL/min; column temperature, 3 min in 40°C, 40–150°C at 5°C/min and finally 2 min in 150°C; injector temperature, 250°C; detector temperature, 270°C; volume injected, 1 mL of the oil in dichloromethane (0.1%); split ratio, 1:50. The MS operating parameters were as follows: ionization potential, 70 eV; ion source temperature, 200°C; quadrapole 100°C, solvent delay 3.0 min, mass range 25–200 amu, Em voltage 3000 volts.

Identification of Compounds. The identification of the GC peaks corresponding to the components of the essential oil was based on direct comparison of the retention times and mass spectral data with those for standard compounds, computer matching with the NIST NBS54K library, and by comparison of the fragmentation patterns of the mass spectra with those reported in the literature [10–12].

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