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Comparison of chemical compounds found in the gum essential oil of male and female *Pistacia atlantica* subsp. Kurdica

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Abstract

This study is the first report to compare the compositions of gum essential oil in male and female *Pistacia atlantica* Subsp. Kurdica. The results showed that the minor differences were found between the compositions of male and female essential oils. The gum of both male and female trees was rich in essential oil (30.80% - 30.27%) and the major compounds were *α*-pinene (92.42% – 84.10%), Limonene (5.23% - 1.26%) and Sabinene (3.29% - 1.580%), respectively. Moreover, Bornyl acetate, neo-Verbenol acetate and 3-oxo-p-Menth-1-en-7-al were found only in female tree.

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Introduction

The genus Pistacia are dioecious tree belongs to the family Anacardiaceae and widely distributed in the Mediterranean and Middle Eastern areas (Yari Kamrani *et al*., 2007). *Pistacia atlantica* is one of the eleven species of genus Pistacia (Zohary, 1952 in İsfendiyaroğlua and Özeker, 2009). Three sub-species (cabulica, kurdica and mutica) described for *P. atlantica* (Rechinger, 1969), while some sources refer to four sub-species (atlantica, mutica, kurdica and cabulica) (Zohary, 1995 in Mehrnejad, 2003; Saffarzadeh *et al*., 1999 in Farhoosh *et al*., 2009). *Pistacia atlantica* Subsp. Kurdica is a native plant of Kurdistan region and it is widely spread around the Zagros Mountains and particularly in Western and Northern Iran, Eastern and Northern Iraq, Southern Turkey and Northern Syria so called Kurdistan (Zohary, 1952 in Sharifi and Hazell, 2011). In Iran especially in Kurdistan, the gum or oleoresin (bneshta tall or jachka talla in Kurdish) of this plant is used traditionally for the treatment of peptic ulcer and wound healing or to make chewing gum. The quality and quantity variations between the content of essential oils related to several factors including plant species and part, sex of cultivars, harvesting time, geographical origin and climatic conditions (Alma *et al*., 2004; Benamar *et al*., 2010 in Bozorgi *et al*., 2013).

The available data about the effect of sex on chemical variation of *Pistacia atlantica* are scarce and it is limited only by leaf (Gourine *et al*., 2009; Roitman *et al*., 2011) and galls (Gourine *et al*., 2011). So, this study is the first report to compare the compositions of gum essential oil in male and female *Pistacia atlantica* Subsp. Kurdica.

Materials and methods

Plant material and essential oil extraction

The gum of *Pistacia atlantica* Subsp. Kurdica was collected from the region of Baneh, Kurdistan, Iran (36°03'N, 45°36'E; 1434 m above sea level) in July 2011. The Essential oils of gum were extracted by hydrodistillation using the Clevenger for 2 h. The Essential oils were dried over anhydrous sodium sulfate and kept at 4°C until analysis.

GC and GC–MS analysis

GC analysis was performed using a Thermoquest gas chromatograph with a flame ionization detector (FID). The analysis was carried out on fused silica capillary DB-5 column (30 m × 0.25 mm i.d.; film thickness 0.25 µm). The injector and detector temperatures were kept at 250 °C and 300 °C, respectively. Nitrogen was used as the carrier gas at a flow rate of 1.1 ml/min; oven temperature program was 60–250 °C at the rate of 4 °C /min and finally held isothermally for 10 min; split ratio was 1:50.

GC–MS analysis was carried out by use of Thermoquest-Finnigan gas chromatograph equipped with fused silica capillary DB-5 column (60 m × 0.25 mm i.d.; film thickness 0.25µm) coupled with a TRACE mass (Manchester, UK). Helium was used as carrier gas with ionization voltage of 70 eV. Ion source and interface temperatures were 200 °C and 250 °C, respectively. Mass range was from 35 to 456 amu. Oven temperature program was the same as mentionned above for the GC.

Data analysis

Statistical analysis was applied for Essential oils data. So, the treatments were arranged in a complete randomized design with three replications. The statistical calculations were performed with SAS software and means were compared using the LSD test ($p \leq 0.05$).

Results and discussion

The essential oil yield obtained from male and female tree of *Pistacia atlantica* Subsp. Kurdica respectively were 30.80% and 30.27% and no significant differences were observed between of them. According to obtained results from the GC-MS and GC analysis (Table 1), low Qualitative and quantitative differences in compositions of essential oils were observed between male and female trees. Twenty-one and twenty-three compounds were

identified in the gum essential oils of male and female respectively. Both male and female tree were rich in alpha-Pinene, but the content of alpha-Pinene in male tree (92.42%) was higher than female tree (84.10%). Other main compounds for both male and female trees were Limonene (5.23% - 1.26%) and Sabinene (3.29% - 1.580%). In addition, the compounds including Bornyl acetate, neo-Verbenol acetate and 3-oxo-p-Menth-1-en-7-al were found. only in female tree.

Table 1. chemical composition of essential oil of *Pistacia atlantica* Subsp. Kurdica gum.

Compound	sex		
	Male	Female	RI [a]
alpha-Pinene	92.420	84.10	945
Camphene	0.530	0.84	957
Thuja-2,4(10)-diene	0.349	0.29	960
Sabinene	1.575	3.29	977
beta-Pinene	0.464	0.06	984
Myrcene	0.076	0.10	989
delta-3-Carene	0.153	0.17	1015
alpha-Terpinene	0.390	0.96	1019
p-Cymene	0.206	2.12	1026
Limonene	1.255	5.53	1032
Terpinolene	0.401	0.13	1092
Linalool	0.052	0.05	1096
alpha-Pinene oxide	0.058	0.07	1104
1,3,8-p-Menthatriene	0.155	0.09	1111
alpha-Campholenal	0.723	0.42	1128
trans-Verbenol	0.154	0.08	1147
Terpinen-4-ol	0.263	0.04	1181
p-Cymen-8-ol	0.251	0.11	1186
alpha-Terpineol	0.162	0.08	1193
Myrtenal	0.148	0.20	1201
cis-4-Caranone	0.216	0.05	1205
Bornyl acetate		1.11	1290
neo-Verbenol acetate		0.03	1326
3-oxo-p-Menth-1-en-7-al		0.08	1342
Essential oil (%)	30.80 [a]	30.27 [a]	

Means with different letters are significantly different by Duncan's test ($p \leq 0.05$).

[a] Retention Index.

In other hand, Sharifi and Hazell (2011) identified 7 compounds from the gum essential oil of *P. atlantica* Subsp. Kurdica (no reported sex). They also reported the content of essential oil and alpha-Pinene 20% and 97.20% respectively that the essential oil obtained in our study is higher than reported by them. Similarly, alpha-Pinene has been reported as main compound from the gum essential oil of *P. atlantica* Subsp. Kurdica (no reported sex) grown in Baneh, Kurdistan, Iran (Salimi *et al.*, 2011). They also reported β-Pinene (7.4%), camphene (2.7%) and verbenol (2.5%) as other major composition that it is different with our results. Furthermore, some minor compounds reported by them that were not found in

our essential oils.

Gourine *et al* (2011) showed Chemical variation in the essential oil of unripe galls of male and female *P. atlantica* (no reported Subsp) grown in Algeria. They also identified the chemotypes of Δ^3-carene (75.34%) and *α*-pinene/*β*-pinene (59.01%/13.26%) respectively for female and male trees. Also, chemical variation between female and male leaves have been reported in *P. atlantica* (no reported Subsp) (Gourine *et al*., 2009) and many of other species including *P. atlantica, P. chinensis, P. lentiscus, P. palaestina, P. terebinthus, P. vera* and *P. weimannifolia* (Roitman *et al*., 2011).

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