

Chemical composition of *Origanum dictamnus* and *Origanum vulgare* ssp. *hirtum* from Greece

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Introduction

Most of the *Origanum* species are locally distributed within the Mediterranean region where they grow in the mountainous areas on the islands. Due to this, the rate of endemism is high (about 70%). *O. vulgare* L. possesses the largest distribution area and can be found throughout the Mediterranean region, in most parts of the Euro-Siberian and the Irano-Turanian regions. The Greek oregano (*O. vulgare* L. ssp. *hirtum*, syn. *O. heracleoticum* L.) is the most commonly used commercial type of oregano. It grows wild throughout nearly across all of Greece. On the other hand, *O. dictamnus* L. also known as dittany of Crete, is native and endemic to the island of Crete, where it grows wild but is also cultivated.

As a herbal tea, oregano is traditionally used for treating respiratory disorders, dyspepsia, painful menstruation, rheumatoid arthritis, scrofulosis and urinary tract disorders. It is also used as a culinary herb in gastronomy. Oregano essential oil with high carvacrol content possesses good antimicrobial and antioxidant properties. Because of this, oregano essential oil rich in carvacrol is a highly valuable raw material for food and in pharmaceutical industry.

No	Compound	Rt	KI	<i>O. dictamnus</i>	<i>O. vulgare</i> ssp. <i>hirtum</i>
1	α -Thujene	5.786	918	0.3	
2	α -Pinene	5.975	927	0.4	0.1
3	Camphene	6.378	935	0.1	0.5
4,5		7.174			0.1
6	β -Pinene + 1-Octen-3-ol	7.411	971	0.4	0.4
7	3-Octanone	7.551	981	-	0.1
8	Myrcene	7.672	987	1.0	1.3
9	3-Octanol	8.030	990	0.1	-
10	α -Phellandrene	8.224	1005	0.1	0.1
11	δ -3-Carene	8.425	1010	0.1	1.1
12	α -Terpinene	8.697	1015	1.5	6.8
13	<i>p</i> -Cymene	8.854	1021	9.8	-
14	Limonene	8.855	1025	0.6	0.5
15	β -Phellandrene	9.160	1025	-	0.1
16	<i>cis</i> - β -Ocimene	9.940	1033	-	4.4
17	γ -Terpinene	10.228	1052	9.0	0.1
18	<i>cis</i> -Sabinene hydrate	11.089	1059	0.4	0.2
19	Terpinolene	11.443	1081	0.1	0.1
20	<i>trans</i> -Sabinene hydrate	11.493	1090	0.1	-
21	Linalool	14.246	1091	0.3	0.4
22	Borneol	14.765	1159	0.3	0.6
23	Terpinen-4-ol	15.371	1172	0.7	0.1
24	α -Terpineol	15.683	1187	0.1	0.1
25	<i>trans</i> -Dihydro carvone	17.700	1196	-	0.3
26	Carvacrol, methyl ether	19.876	1241	0.2	0.5
27	Thymol	20.476	1290	0.3	78.5
28	Carvacrol	23.582	1302	70.8	-
29	α -Copaene	25.462	1374	0.1	1.3
30	<i>trans</i> -Caryophyllene	26.918	1418	1.2	0.2
31	α -Humulene	29.250	1452	0.1	1.1
32	β -Bisabolene	29.854	1508	0.4	-
33	δ -Cadinene	32.251	1522	0.1	0.3
34	Caryophyllene oxide	33.520	1580	0.3	-
35	1,10-di- <i>epi</i> -Cubenol	35.021	1612	0.1	-
	α -Cadinol		1654	0.1	-
	TOTAL			99.1	99.4

Materials and Methods

Dry commercial *O. dictamnus* and *O. vulgare* ssp. *hirtum* were purchased at a local market in Greece (producer Avramglou, Thessaloniki) in 2018. Air-dried aerial parts of *Origanum* were submitted to hydrodistillation (Clevenger apparatus, 3 h). Then, the essential oil was dried over anhydrous sodium sulfate and analyzed using an HP 5890 gas chromatograph coupled to an HP 5973 MSD and fitted with a capillary column HP-5 MS (30 m \times 0.25 mm \times 0.25 μ m film thickness). Analytical conditions were as follows: helium was used as carrier gas; inlet pressure was 25 kPa; linear velocity: 1 ml/min at 210 °C; injector temperature: 250 °C; injection mode: splitless. MS scan conditions were: source temperature, 200 °C; interface temperature, 250 °C; electron energy, 70 eV; mass scanrange, 40–350 *amu*. Temperature program: 60 °C to 285 °C at a rate of 4.3 °C/min. The components were identified based on their linear retention index relative to C8–C32 *n*-alkanes, comparison with data reported in literature (Wiley and NIST databases). Percentage (relative) of the identified compounds was computed from GC peak area.



O. dictamnus



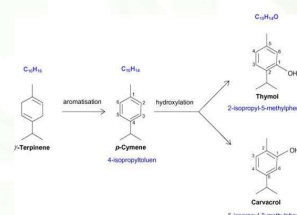
O. vulgare ssp. *hirtum*

Results

A total of 35 compounds were detected in Greece *Origanum* essential oils. In *O. dictamnus* 31 compounds comprised 99.1%, carvacrol being the dominant compound with 70.8%, followed by *p*-cymene (9.8%) and γ -terpinene (9.0%). A GC-MS chromatogram of *O. dictamnus* essential oil is shown in Figure 1a. The sum of the three above mentioned major essential oil constituents in *O. dictamnus* was 89.6%. In *O. vulgare* ssp. *hirtum* 28 compounds comprised 99.4%, the dominant compound was carvacrol with 78.5%, followed by *p*-cymene (6.8%) and γ -terpinene (4.4%). A GC-MS chromatogram of *O. vulgare* ssp. *hirtum* essential oil is shown in Figure 1b. The sum of these three major constituents was 89.7%. However, thymol as an isomer of carvacrol in both samples was present in low concentrations (with 0.3% and 0.5%, respectively).

Discussion

It is well known that essential oils of *Origanum* species is rich in cymyl-compounds, i.e. phenolic monoterpenoids, such as carvacrol (2-Methyl-5-(propan-2-yl)phenol) and thymol (5-Methyl-2-(propan-2-yl)phenol), and its biosynthetic precursors (γ -terpinene and *p*-cymene).



Conclusions

Because of the high content of carvacrol in the respective essential oils, *O. dictamnus* and *O. vulgare* ssp. *hirtum* from Greece have high quality and represent highly valuable raw material for food and in pharmaceutical industry.