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Chemical Composition, Antioxidative and Antibacterial Activity of the Essential Oils of Wild and Cultivated *Thymus vulgaris* from Iran

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The volatile components of the thyme oil have been considered as one of the ten top essential oils worldwide showing remarkable biological or medicinal activities[1,2]. Four species of the genus *thymus* are grown in Iran[3].

The objective of study was to compare the composition, antioxidative and antibacterial activity (against food-borne pathogens) of essential oils of wild and cultivated *thymus vulgaris* (family: Lamiaceae).

The aerial parts of both cultivated and wild plants were collected in May 2011 from Shahrekord (Chaharmahal va Bakhtiari Province). The oils were obtained by hydro-distillation using a clevenger-type apparatus. Analyses of the oils were carried out using an Agilent HP-6890 gas chromatograph equipped with a flame ionization detector (FID) and a HP-5MS column (30 m × 0.25 mm, film thickness 0.25 ìm). The GC/MS analyses were carried out using an Agilent HP-6890 gas chromatograph coupled with an Agilent HP-5973 mass spectrometer.

Antibacterial activity assessment was performed according to Saei-Dehkordi *et al*.[4] and NCCLS[5]. The test microorganisms were: *Staphylococcus aureus* ATCC 25923, *Bacillus cereus* ATCC 11778, *Escherichia coli* O157:H7 ATCC 25922 and *Pseudomonas aeruginosa* ATCC 27853. Also, amikacin was used as a standard antibacterial agent. DPPH assay and γ-carotene/ linoleic acid bleaching method were used to determine antioxidative activity of the oils[4,6].

The major constituents of the wild plant oil were thymol (64.61%), carvacrol (6.35%), γ-Terpinene (6.20%) and *p*-Cymene (5.40%). The main components of the cultivated plant oil were thymol (49.58%), *p*-Cymene (14.23), γ-Terpinene (10.17%) and Trans-Caryophyllene (3.15%) (Table 1). The thymol was the most abundant constituents reported in a previous study[8]. In both cultivated and wild plants the oxygenated monoterpenes were the major compounds. The oil of wild plant exhibited a more prominent antibacterial activity. The oil of wild plant showed stronger antioxidative activity compared to that of cultivated plant. The more prominent antibacterial and antioxidative activity could result from the higher content of oxygenated monoterpenes in the oil of wild plant[4].

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Table 1. Chemical Composition of the Essential oils of Wild and Cultivated Plant of *Thymus vulgaris*

No.	RI	Percentage in oil	
		Wild	Cultivated
α-Pinene	936	0.15	0.73
Camphene	948	0.33	1.14
β-Pinene	936	0.15	0.73
Camphene	948	0.33	1.14
α-Pinene	977	–	0.21
1-Octen-3-ol	981	–	0.17
β-Myrcene MH	987	0.24	0.98
α-Phellandrene MH	1001	–	0.27
α-Terpinene MH	1012	0.26	2.87
p-Cymene MH	1021	5.40	14.23
Limonene MH	1027	0.88	1.17
1,8-Cineole	1030	0.53	1.12
γ-Terpinene MH	1056	6.20	10.17
cis-Sabinene hydrate	1064	1.15	0.75
Linalool	1097	2.01	1.42
Borneol	1162	1.41	0.53
Terpinene-4-ol	1174	0.40	0.36
Thymol methyl ether	1231	0.60	0.09
Carvacrol methyl ether	1241	0.89	1.41
Thymol	1298	64.61	49.58
Carvacrol	1304	6.35	2.77
Thymoyl acetate	1356	0.44	0.13
Trans-Caryophyllene	1417	1.31	3.15
α-Humulene	1451	0.19	–
allo-Aromadendrene	1461	–	0.05
Germacrene *D*	1480	0.11	0.35
α-Selinene	1493	0.66	1.51
β-Bisabolene	1505	0.36	1.23
γ-Cadinene	1511	0.54	0.22
δ-Cadinene	1521	0.65	0.15
Spathulenol	1575	0.05	–
Caryophyllene oxide	1581	2.01	1.79
Khusinol	1677	0.58	–
Monoterpene hydrocarbons		13.46	31.77
Oxygenated monoterpenes		78.39	58.16
Total monoterpenoids		91.85	89.93
Sesquiterpene hydrocarbons		3.82	6.66
Oxygenated sesquiterpens		2.64	1.79
Total sesquiterpenoids		6.46	8.45
Others		–	0.17
		98.31	98.55

RI: Retention indices (HP-5MS column).

Table 2. Antibacterial Activity (MIC in μg/mL) of the Essential Oil Wild and Cultivated Plant of *Thymus vulgaris*

Organism	Essential oil		Standard drug
	Wild	Cultivated	(Amikacin)
Staphylococcus aureus	200	300	2
Listeria monocytogenes	150	200	0.5
Bacillus cereus	200	400	0.5
Escherichia coli O157:H7	500	600	2
Pseudomonas aeroginaosa	500	800	1

Table 3. Antioxidative Activity of the Essential Oil Wild and Cultivated Plant of *Thymus vulgaris* [a]

Sample	DPPH, IC_{50} (μg/mL)	β-carotene/linoleic acid bleaching, RAA (%)
Essential oil (wild)	21.62 ± 0.9	96.31 ± 0.8
Essential oil (cultivated)	27.35 ± 1.2	89.87 ± 1.1
BHT[b]	18.25 ± 1.6	100
Ascorbic acid[b]	5.90 ± 0.53	98.16 ± 1.25

[a] Values are expressed as means ± SD of three parallel measurements.
[b] Positive controls

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