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Comparative Study of Compositions of *Thymus serpyllum* L. Essential Oil

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The essential oils isolated by hydro-distillation and two new designed Erfani steam distillation, Mehri steam distillation from the whole pant of *Thymus serpyllum*, at full flowering stage were analyzed by capillary GC and GC/MS. Among the 43 compounds identified, the major components were α-pinene (12.2, 2 and 13.6 %), myrecene (0.18, 0.69 and 3.21 %) *p*-cymene (2.54, 8.21 and 4.11 %), thymol (7.39, 8.4 and 3.74 %) and cavacrol (14.94, 37.27 and 11.09 %) during full flowering stage, respectively.

Key Words: *Thymus serpyllum*, Lamiaceae, Essential oil, γ-Terpinene, *p*-Cymene.

INTRODUCTION

The genus of Thymus presents 14 species which are found wild in different regions of Iran[1], four of which are endemic. The endemic and non-endemic (cultivated) Thymus species has been reported previously[2,3]. In this paper, the oil composition of *T. serpyllum* is introduced, which was found in rock (stone growth) by three methods of essential oil extraction. The chemical composition, thymol and carvacrol content, insecticidal and antimicrobial effect of *T. serpyllum* oil have been the subject of previous study[6-10]. A comparison between the oil and supercritical carbon dioxide extract of Hungarian *T. serpyllum* has also been reported[11].

EXPERIMENTAL

Plant materials were collected from the south west of Iran (Losetan Province) full flowering stage in murch 2006. A specimen has been deposited in the Herbarium of Research Institute of Forests and Rangelands (TARI). Whole dried plant (45 g for hydro-distillation (HD), 10 g for Mehri

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steam distillation (MSD) and 2 kg for Erfani steam distillation (ESD) were distilled for 4 h, 20 min and 12 h, respectivly to produce a yellow oil in yields of 0.90, 1.20 and 2.50 % w/w (full flowering). The oils were dried over anhydrous calcium chloride and stored in sealed vials at a low temperature prior to analysis.

The oil from the whole plant of *T. serpyllum*, during full flowering stage was investigated by capillary GC and GC/MS. GC analysis was performed using a Shimadzu GC-17A equipped with a DB-5 column (60 m × 0.25 mm, 0.32 µm film thickness). Oven temperature was held at 60°C for 5 min and then programmed to 265°C at a rate of 5°C/min, injector and detector temperature were 265°C, carrier gas was helium with a linear velocity of 32 cm/s. GC/MS analysis was carried out on a Shimutzu QP5050 GC/MS system equipped with a PB-5 fused silica column (60 m × 0.25 mm); oven temperature, 60-260°C at a rate of 5°C/min, transfer line temperature 265°C, carrier was helium with a linear velocity of 31.5 cm/s; split ratio 1/60; ionization energy 70 eV; scan time 1 s; mass range 40-300 amu. The list of the constituents identified are presented in Table-1. They were identified by comparison of their mass spectra with those in the computer library or with authentic compounds. The identifications were confirmed by comparison of their retention indices either with those of authentic compounds or with data in the literature[12,13].

RESULTS AND DISCUSSION

43 Compounds were identified in the oil of *T. serpyllum* at full-flowering, representing 98.0 % of the oil by HD, 95 % by MSD and by ESD 97 %. The major components were α-pinene (12.2, 2 and 13.6 %), myrecene (0.18, 0.69 and 3.21%), *p*-cymene (2.54, 8.21 and 4.11 %), thymol (7.39, 8.4 and 3.74 %) and cavacrol (14.94, 37.27 and 11.09 %) during full flowering stage, respectively. The content of thymol and carvacrol found in present oil of *T. serpyllum* was less than in other species found in Iran[2-5]. In regard to the previously reported contents of the essential oil, it is interesting to point out that there are no important qualitative differences between the present work and previous studies[2-5] but there are some quantitative differences indicating that kind of apparatuses concerned. These chemical differences can be most probably explained by the variability of the apparatus.

The extracted oils of the 3 different methods are rich in monoterpene phenols (especially, thymol and carvacrol) and due to this high phenol content, they can be considered as substitutes for *T. vulgaris* (common thyme) oil for medicinal purposes and other applications. In addition, the Iranian *T. sperryll* may be a potential thymol-rich source for commercial cultivation.

TABLE-1
COMPOSITION OF ESSENTIAL OIL OF *Thymus* sp. BY THREE DIFFERENT METHODS

No.	Compounds	Tn	RI	HD (%)	ESD (%)	MSD (%)
1	α-Pinene	5.40	930	12.2	2	13.60
2	Camphene	5.80	943	–	–	6.60
3	Verbenene	5.90	952	–	–	0.90
4	Sabinene	6.40	969	–	0.26	–
5	β-Pinene	6.50	971	–	0.61	3.39
6	1-Octen-3-ol	6.60	978	–	0.25	–
7	Myrcene	6.90	985	0.18	0.69	3.21
8	3-Octanol	7.10	993	–	0.21	–
9	α-Phellandrene	7.30	1002	–	0.09	0.83
10	α-Terpinene	7.60	1014	0.21	0.72	–
11	*p*-Cymene	7.90	1023	2.54	8.21	4.11
12	1,8-Cineole	8.00	1026	0.76	4.45	–
13	Limonene	8.07	1027	–	–	3.17
14	(E)-Ocimene	8.60	1047	–	0.02	–
15	γ-Terpinene	8.90	1057	–	3.61	–
16	*trans*-Sabinene hydrate	9.10	1064	–	0.08	–
17	α-Terpinolene	9.70	1085	0.82	0.09	1.88
18	Linalool	10.10	1098	0.10	0.37	0.5
19	*iso*-Pulegol	10.70	1112	–	0.01	–
20	Camphenol	10.90	1122	–	–	1.20
21	*cis*-Verbenol	11.00	1139	–	–	0.53
22	Pinocarvone	12.00	1160	–	–	0.42
23	Broneol	12.10	1164	–	0.12	0.40
24	Terpinen-4-ol	12.40	1173	–	0.57	0.28
25	α-Terpineol	12.80	1186	–	0.48	0.43
26	Myrtenol	13.00	1187	–	–	1.18
27	*cis*-Dihydrocarvone	13.20	1198	–	0.09	–
28	*trans*-(+)-Carveol	13.70	1215	–	–	0.27
29	Carvacrol methyl ether	14.40	1241	0.28	0.71	–
30	(+)-Pullegone	14.70	1249	–	0.21	–
31	Bornyl acetate	15.70	1283	–	–	7.74
32	Thymol	16.00	1285	7.39	8.40	3.74
33	Carvacrol	16.40	1293	14.94	37.27	11.09
34	Carvacryl acetate	18.20	1305	0.31	1.34	–
35	β-Bourbonene	18.50	1382	–	–	0.28
36	β-Caryophyllene	19.40	1414	0.59	0.60	1.07
37	Aromadendrene	19.90	1448	–	0.16	–
38	Pentadecane	21.5	1495	0.54	–	0.11
39	Elemol	22.9	1548	–	–	0.46
40	Spathulenol	23.5	1572	–	0.78	1.13
41	Caryophyllene oxide	23.7	1581	–	–	0.67
42	Hexadecane	24.1	1596	0.40	–	0.75
43	α-Bisabolene epoxide	25.00	1632	–	0.04	–

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