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Habitat Influence on Essential Oil of *Camphorosma monspeliaca* L. in Iran

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Abstract: *Camphorosma monspeliaca* L. were collected in full flowering stage from 3 different habitats in Iran. Essential oil of aerial parts was obtained using cellevenger apparatus and chemical composition were analyzed by GC and GC/MS and identified in comparison with authentic compounds. The yields of essential oils were to 0.15 v/w% and the major compounds in 3 habitats were α-pinene, citronellyl pentanoate, endo-bourbonanol, α-fenchene, trans-pinocarveol, limonene, pinocarvone, camphene and dill ether.

Key words: *Camphorosma monspeliaca*, essential oil composition, α-pinene, citronellyl pentanoate

INTRODUCTION

Camphorosma monspeliaca L. is an ever green shrub belonging to chenopodiaceae family, growing up to 0.6 m and locally named KAFURI and flowered in October (Moghimi, 2006). The scented flowers are hermaphrodite and are pollinated by insects. The stems and leaves are emitted a powerful camphor-like scent (Thomas, 2006). The plant prefers light (sandy) and medium (loamy) soils and requires well drained soils also prefers acidius, neutral and basic soils and can grow in high alkaline and saline soils and can tolerate to drought (Moghimi, 2006; Genders, 2001).

This plant has some medicinal uses such as: Antiasthmatic, diaphoretic, diuretic, emmenagogue, expectorant and stimulant (Usher, 1974). There is only one pre-report on the essential oil composition of this species (Bahernik and Mirza, 2003) and since this plant growth in different habitats and noted for livestock grazing so we aimed to study the essential oil composition of this plant in 3 main habitats in Iran at full flowering stage and compared with each other. These habitats including, Hamedan area (337 km Southwest of Tehran) with 334.7 mm annual precipitation, 11°C mean annual temperature, 53.5% relative humidity and 4.15 dS m^{-1} soil salinity, Shahr-e-Kord area (543 km Southwest of Tehran) with 317.7 mm annual precipitation, 11.8°C mean annual temperature, 46% relative humidity and 0.42 dS m^{-1} soil salinity and Arak area (293 km south of Tehran) with 222.2 mm annual precipitation, 12.7°C mean annual temperature, 48.6% relative humidity and 9.41 dS m^{-1} soil salinity.

MATERIALS AND METHODS

Plant material and essential oil: Aerial parts of the plant were collected at full flowering stage in 2006 from 3 mentioned habitats in Iran. Plant materials were dried at ambient temperature and shade condition. Voucher specimen is identified and deposited under No. 6679-THE at the herbarium of Faculty of Pharmacy, Tehran University of Medical Sciences. The essential oil of air-dried samples (100 g) of each site was isolated by hydro distillation for 3 h, using a Clevenger-type apparatus. The distillated oils were dried over anhydrous sodium sulfate and stored in tightly closed dark vials at 4°C (Amin *et al*., 2005) until analyzing time.

GC analysis: GC analysis was performed by using a thermoquest gas chromatography Shimadzu 9A, with a Flame Ionization Detector (FID) and carried out using fused silica capillary DB-5 column (60 m* 0.25 mm i.d., film thickness 0.25 μm). The operating conditions were as follows: Injector and detector temperatures were 250 and 300°C, respectively. Nitrogen was used as carrier gas at a flow rate of mL min^{-1}; oven temperature programmed 60-250°C at the rate of 5°C min^{-1} and finally held isothermally for 10 min.

GC-MS analysis: GC-MS analysis was performed by using a thermoquest-finigan gas chromatograph Varian 3400, equipped with above mentioned column and coupled to trace Mass quadrupled detector. Helium was used as carrier gas with ionization voltage of 70 eV. Ion source and interface temperature were 200 and 250°C,

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respectively. Mass range was form m z^{-1} 43-456. Gas chromatographic conditions were as given for GC. Identification of compound: The chemical compounds of essential oil were identified by calculation of their retention indices under temperature-programmed conditions for n-alkanes (c8-c24) and the oil on DB-5 column under the same chromatographic conditions. Identification of individual compounds was made by comparison of their Mass spectra with those of the internal reference Mass spectra library or with authentic compounds and confirmed by comparison of their retention indices with authentic compounds in literature (Adams, 2004; Connolly and Hill, 1991). For quantitative purpose, relative area percentages obtained by GC/FID were used without the use of correction factors.

RESULTS AND DISCUSSION

The average yield of essential oil in 3 areas were 0.1 to 0.15% (Hamedan = 0.1%, Shahr-e-Kord = 0.1%, Arak = 0.15%). The identified compounds of essential oil were different in these 3 habitats (Hamedan 103, Shahr-e-Kord 78 and Arak 55 compounds) and were shown in Table 1. Based on identified compounds we recognized over 95% of total oil of *Camphorosma monspeliaca* L. in 3 mentioned areas (Hamedan 95.057%, Shahr-e-kord 95.235 % and Arak 95.038%).

Overall, 104 components were identified over 95% of total essential oil of *Camphorosma monspeliaca* L. (Table 1) based on GC/MS data of three habitats (Hamedan 103, Shahr-e-Kord 78 and Arak 55 compounds). The major same components of three areas were α-pinene (10.2-15.7%), Citronellyl pentanoate, (2.6-8.4), endo-1-bourbonanol (1.99-7.3%), α-fenchene (4.7-5.9%), trans-pinocarveol (2.3-3.4%), limonene (2.5-3.1%), pinocarvone (2.4-3.1%), camphene (1.8-2.8%) and dill ether (1-1.5%). These results are very different from the only pre-report on the essential oil of *Camphorosma monspeliaca* L. (Bahernik and Mirza, 2003) which characterized some other components e.g., α-cadinol (9.1%), octen-3-ol (8.2%), β-eudesmol (7.3%), β-bisabolene (6.1%), 2-tridecanone (5.1%), β-cubebene (3.4%), neryl acetate (3.0%) and no data for collection localities.

Comparison of the percentage of 9 major compounds based on GC/FID data, showed that these compounds are in higher amount with Arak area, while it has the higher amount of soil salinity (9.41 dS m^{-1}) and lower amount of annual precipitation (222.2 mm) among these three areas (Table 1). It is very interesting that camphor, a responsible compound for Kafuri smel's is omitted in the essential oil belonging to Arak area (Table 1) and it may be causes for livestock grazing of this species more simply than two other areas that having camphor.

Table 1: Chemical composition and percent of the essential oil of *Camphorosma monspeliaca* L. in 3 studying habitats of Iran

			(GC) (%)		
Compounds	RT	RRI	H	SH	A
Santolina triene	15.27	907	0.324	0.651	0.620
Tricyclen	16.36	924	0.188	-	-
α-pinene	17.24	938	10.205	13.158	15.760
3-methyl-cyclohexanone	17.66	944	0.626	-	-
α-fenchene	18.05	950	4.708	5.304	5.970
Camphene	18.15	952	1.884	2.597	2.858
Benzaldehyde	18.88	964	0.910	1.114	0.995
Trans-para-methane	19.89	980	1.945	4.227	-
Dehydro-1,8-cineole	20.71	993	0.438	0.734	-
2-octanal	21.15	1000	0.134	0.466	-
N-octanal	21.42	1004	0.258	0.541	1.193
Ortho-cymene	22.93	1028	0.544	1.314	1.068
Limonene	23.22	1032	2.537	3.144	2.627
1,8-cineole	23.36	1034	0.463	0.697	-
γ-terpinene	25.08	1062	0.141	-	-
Acetophenone	25.68	1071	0.619	1.022	0.868
Linalool	27.73	1103	0.213	-	-
Nonanal	27.91	1106	1.163	1.027	1.699
Cis-rose oxide	28.35	1113	0.326	-	-
Mentha-2,8-dien-1-oL	29.20	1127	0.984	1.214	0.867
α-campholenal	29.45	1131	0.602	0.593	0.879
Cis-para-mentha-2,8-dien-1-oL	30.14	1142	0.334	0.640	-
Trans-pinocarveol	30.50	1148	3.448	2.336	3.376
Trans-verbenol	30.76	1152	0.426	0.823	1.249
Camphor	31.14	1158	0.575	0.714	-
Karahanaenone	31.45	1163	0.472	-	0.493
Pinocarvone	31.89	1170	2.959	2.442	3.113
Borneole	32.13	1174	0.501	0.380	0.722
Para-mentha-1,5-dien-8-oL	32.38	1178	0.525	-	-
Cis-pinocarveol	32.59	1182	0.684	1.090	1.502
Cryptone	32.83	1184	-	-	0.470
Dill ether	33.18	1191	1.519	1.071	1.427
α-terpineol	33.63	1199	2.580	2.406	1.230
Myrtenol	34.04	1205	0.859	0.546	3.298
Dihydro-trans-carvone	34.29	1210	0.244	1.707	0.178
Trans-pulegol	34.61	1215	0.977	1.058	0.411
Dihydro-neoiso-carveol	35.01	1222	0.349	-	-
Trans-carveol	35.28	1227	0.241	0.245	1.325
Cis-para-mentha-1(7),8-dien-2-oL	35.84	1236	0.717	0.855	0.659
Pulegone	36.25	1243	0.203	0.707	-
Cumin aldehyde	36.51	1247	0.274	0.550	-
Carvone	36.73	1251	0.831	0.461	1.236
Cis-piperitone epoxide	37.54	1265	0.585	0.671	0.578
Trans-piperitine epxide	38.13	1275	0.418	0.375	0.430
Trans-myrtenol	38.36	1279	0.712	0.843	0.838
Perilla alcohol	38.61	1283	1.881	0.660	2.178
N-tridecane	39.32	1295	1.568	0.896	1.852
Neoiso-isopulegyl acetate	39.90	1305	1.245	1.849	1.628
Cyclohexanol acetate	41.12	1327	0.256	-	-
Trimethyl benzaldehyde	41.35	1331	0.442	-	0.652
4-hydroxy-cryptone	41.62	1336	1.205	0.818	-
2E,4E-decadienal	41.78	1339	1.035	-	-
Verbanol acetate	42.72	1356	0.329	-	-
Citronellyl acetate	42.98	1361	0.250	0.506	-
Neryl acetate	43.31	1367	0.846	0.890	1.710
Trans-myrtenol acetate	43.70	1373	0.329	-	-
Sativene	43.84	1376	0.240	-	-
Methyl perillate	44.67	1391	0.528	0.896	0.460
N-tetradecane	44.90	1395	0.524	1.039	-
4,8-epoxy caryophllane	45.73	1410	0.408	-	0.711
Cis-carvyl propanoate	46.18	1419	0.292	-	0.739
Para-menth-1-en-9-ol acetate	46.58	1427	0.113	0.639	0.397
Allyl cyclohexyl propanoate	47.31	1440	0.469	0.776	0.342
2E-dodecenal	48.14	1456	0.167	0.559	0.462
2E-ethyl cinnamate	49.04	1473	0.369	0.421	-

Table 1: Continued

Compounds	RT	RRI	(GC) (%) H	SH	A
N-dodecanol	49.24	1477	0.378	-	-
2E-dodecen-1-ol	49.62	1484	0.390	-	0.510
Isobornyl n-butanoate	49.91	1490	0.231	-	-
Neryl isobutanoate	49.99	1491	0.293	0.767	-
2-tridecanone	50.36	1498	0.878	0.446	-
Endo-1-bourbonanol	50.64	1504	6.143	1.996	7.384
Citronellyl butanoate	52.34	1538	1.118	0.495	1.492
1,10-decanediol	52.61	1543	0.365	0.520	-
1-nor-bourbonanone	52.89	1549	0.585	1.996	-
Longicamphenylone	53.45	1560	0.241	0.464	-
Davanone B	54.29	1577	0.518	0.589	-
(Z)-dihydro apofarnesol	54.59	1583	0.533	-	1.457
Neryl isovalerate	54.73	1586	0.641	1.200	-
Virdiflorol	55.49	1601	0.304	-	-
Widdrol	55.63	1604	0.308	0.677	-
Sesquithuriferol	55.95	1611	1.215	0.610	2.597
β-atlantol	56.17	1615	0.232	0.442	-
Citronellyl pentanoate	56.67	1626	8.443	2.611	6.310
β-cedren-9-one	57.25	1638	0.356	0.988	-
E-sesquilavandulol	58.12	1657	0.409	1.094	1.086
Selina-3,11-dien-6-ol	58.48	1664	0.845	2.103	0.603
β-eudesmol	58.68	1668	0.372	0.542	1.273
(Z)-trans-bergamotol	59.71	1690	0.294	1.034	-
Sesquicineol-2-one	60.27	1702	0.338	0.634	0.631
Longifolol	60.65	1723	0.170	0.170	0.689
Zerumbone	61.61	1732	1.265	0.522	1.244
Curcumenol	61.96	1740	0.524	1.583	-
E-isoamyl cinnamate	62.45	1751	0.629	1.087	-
β-bisabolenal	64.33	1792	0.482	0.564	-
1-octadecene	65.07	1810	0.758	0.534	-
α-chenopodiol	66.71	1851	0.607	0.462	0.273
3Z-hexenyl cinnamate	67.12	1862	0.203	1.566	-
Methyl linoleate	71.56	2010	0.462	-	-
Heneicosane	73.42	2099	0.336	-	-
Methyl octadecanoate	73.71	2116	0.296	-	-
3,5-dimethyoxy-stilbene	76.70	2299	0.579	0.823	-
Trans-ferruginol acetate	77.81	2378	0.507	0.641	0.416
Methyl strictate	78.05	2395	0.390	0.385	-
N-pentacosane	79.56	2499	0.253	-	-
Total percentge of identified compounds			95.038	95.235	95.057

RT: Retention Time, RRI: Relative Retention Indices, (%) (GC): Percentage according to GC spectrum, H: Hamedan, SH: Shahr-e-Kord, A: Arak

α-pinene, with 15.76% of the total essential oil of Arak samples is the major chemical component of these 3 areas (Table 1). Hamedan area, is the second's one in this comparative stage while it has the second range of soil salinity (4.15 dS m^{-1}) but first range of annual precipitation (334.7 mm)and the most amount of chemical components (103 compounds). It is mentioned that the number of components were increased with increasing of annual precipitation (334.7 mm for Hamedan) and decreased based on increasing of soil salinity (9.41d S m^{-1} for Arak), so however *Camphorosma monspeliaca* L. is a halophyte plant but it will produce more essential components based on local annual precipitation.

Since some of major components of essential oil of *Camphorosma monspeliaca* L. like Pinocarvone and trans-Pinocarveol are anti-microbial compounds (Asakawa *et al*., 1986) we recommend the *in vivo* and *in vitro* experiments for determining the anti-microbial activity of this plant.

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