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Research Paper

Variations of essential oils in fresh and dried aerial parts of *Prangos uloptera*

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ABSTRACT

The volatile oils of *Prangos uloptera* DC. (*Umbelliferae*) aerial parts in their fresh and dry states were investigated. The objective of the study was to compare the oil yields, oil components along with their percentages in the two stages (fresh/dry). The essential oils in both stages were obtained by hydrodistillation and analyzed through GC and GC/MS. The yields of oils were 0.3% for fresh and 0.15% for dried aerial parts. Thirty-five vs. thirty-eight compounds were identified in the oil of fresh vs. dried aerial parts, respectively. The major constituents of fresh aerial parts' oil were α-pinene (20.29%), *trans*-β-ocimene (19.64%), β-caryophyllene (9.95%), δ-3-carene (8.03%), germacrene D (6.02%) and β-myrcene (3.89%), whereas the oil of dried aerial parts were mainly comprised of β-caryophyllene (13.94%), α-pinene (13.62%), caryophyllene-oxide (11.62%), spathulenol (7.79%) and germacrene D (4.73%). Contrary to β-caryophyllene which was found as an exception, the percentages of all main components identified in the oils (both stages) were lower in the dry stage oil than in the oil of fresh aerial parts. Furthermore, δ-3-carene as a major compound in the fresh stage oil was absent in the oil extracted from dried aerial parts.

Keywords: α-pinene; β-caryophyllene; GC/MS; *Umbelliferae*; Volatile components.

INTRODUCTION

The volatile oil obtained by hydrodistillation from *Prangos uloptera* (*Umbelliferae*) aerial parts has been previously reported (Mazloomifar et al., 2004). In that study, twenty-eight oil constituents representing 89.1% of the oil content were identified. The main components were β-caryophyllene (27.1%), caryophyllene-oxide (15.9%), α-pinene (12.4%) and limonene (8.7%). Study of *P. uloptera* shows β-caryophyllene (18.2%), germacrene D (17.2%) and limonene (8.7%) were the main compounds of the oil in the aerial parts, while the seed oil was mainly constituted of α-pinene (41.5%) and β-cedrene (4.0%) (Sefidkon and Najafpour, 2001).

In the present work, volatile oils from *P. uloptera* aerial parts (in either fresh or the dry state) were extracted for an evaluation of variations, yields, and the principal constituting components. The aim of this study is to find out the essential oils quality and quantity and determine their variations in dried and fresh aerial parts of *P. uloptera*.

MATERIALS AND METHODS

Plant material: The aerial parts of the plant were collected from Taleghan, 110 km northwest of Tehran, Iran, in June 2009, at their flowering stage. A voucher specimen (No. 6694-THE) was identified by Dr. Gholamreza Amin from the Herbarium of Pharmacognosy Department, Tehran University of Medical Sciences, Tehran, Iran.

Isolation of the volatile oils: The aerial parts of the plant (100g) in their two states; once when they were fresh and next when they were air-dried at ambient temperature, were separately powdered and then hydrodistilled for 4h in a Clevenger-type apparatus. The distillated oils were dried over anhydrous sodium sulfate and stored in sealed vials at 4°C before being analyzed.

Qualitative analysis: The oil was investigated through capillary GC (Agilent 6890), carried out using fused silica capillary DB-5 column (30 m × 0.25 mm, film thickness 0.25µm) by a temperature program of 50-240°C at 3°C min^{-1}, injector and detector temperatures of 290°C. GC/MS analysis was carried out using Agilent 5973. EI mass spectra were measured through an ionization voltage of 70 eV; ion source temperature of 220°C equipped with a HP-5MS capillary column (30 m × 0.25 mm, film thickness 0.25µm) with helium as the carrier gas with a flow rate of 0.8ml/min. Retention indices were found out using retention times of *n*-alkanes injected under the same chromatographic conditions. Identification of the components was made through a comparison of their mass spectra and relative retention indices (RRI-HP-5) with either those given in the literature or with authentic samples (Adams, 2004). For quantitative analysis, relative percentages of individual components were found based upon the peak areas obtained through GC with use of no correction factors.

RESULTS

According to the results, the essential oils isolated by hydrodistillation from fresh and dried aerial parts of *Prangos uloptera* were obtained in yields of 0.3 and 0.15% (w/w), respectively.

Thirty-five components were identified in the fresh aerial parts' oil content, representing about 93.14% of the total oil's compounds. Thirty-eight compounds were identified in the oil extracted from dried aerial parts, representing 92.36% of the total oil's components. The identified components of fresh/dried *P. uloptera* aerial parts and their percentages are given in Table 1. The constituents are listed in order of their elution on the DB-5 column.

The oil yield from the fresh aerial parts was higher than that obtained from the dried aerial parts. As indicated in Table 1, α-pinene and germacrene D were identified in the oils of both of the two studied stages as their major compounds but the percentages were lower in the dry plant parts' oil than in the oil extracted from the fresh aerial parts. Contrary to the oil in the fresh stage, the oil of dry state did not contain *trans*-β-ocimene and β-myrcene as main constituents. The content of δ-3-carene reached 8.03% in the oil obtained from the fresh state, but it was absent in dried *P. uloptera* aerial parts' oil. Among the main components found in the oils of plant at both stages, β-caryophyllene was the sole major compound the percent content of which was higher in the dry plants' oil than in the fresh plants' oil namely: 13.94 vs. 9.95%. It is notable that the contents of caryophyllene-oxide and spathulenol reached 11.62 and 7.79% in the oil extracted from the dried aerial parts respectively, while they were not existent as major components in the plant fresh aerial parts' oil. These differences reveal the fact that the essential oil obtained from fresh *P. uloptera* varied qualitatively as well as quantitatively from that extracted from the plant parts in their dry state.

DISCUSSION

Principal constituting components of the essential oils of *P. uloptera* were different in dry and fresh aerial parts. Some of the chemical compounds the percentages of which decreased in the oil of dry stage are poisonous if eaten. As cited in literature; among the above decreased compounds in *P. uloptera* oil at its dry stage, β-myrcene and α-pinene inflict harmful biological effects on animals. Azarnivand et al. (2011), compared the essential oils from *F. ovine* aerial parts in fresh and dry stages and showed that among the chemical compounds the percentages of which decreased in *F. ovina* dry stage oil, beta-myrcene and limonene have harmful biological effects. Based on previous reports (EPA, 2005; Paumgartten, et al., 1990) concerning the above mentioned compounds; α-pinene is toxic (when taken up via oral, dermal and inhalation routes) and irritant to the skin, eye and mucous membranes; β-myrcene tends to disturbing the digestive system and being toxic to the stomach and liver. The amount of β-myrcene as a poisonous component identified in the oils of *F. ovine* (Azarnivand, et al., 2011) and *P. uloptera* (current work), was higher in fresh stage oil than that in dry stage oil. In above studies, it is notable that both of the species are from *Umbelliferae* family and moreover; both of the mentioned plants were collected from the same region (Taleghan). Various other reports have confirmed the noxious effects of plant volatile oils (Abramov, et al., 2001; Delgado, et al., 1993; De-Oliveira, et al., 1997; Zeinsteger, et al., 2003).

During the present probe along with other previous studies (Sefidkon and Najafpour, 2001; Mazloomifar, et al., 2004), it was recognized that β-caryophyllene and germacrene D were the major constituents of oil in *P. uloptera* aerial parts. Moreover it was found out that the content of α-pinene was higher in seed oil than in oil of plant's aerial parts. *P. uloptera*'s oil caryophyllene-oxide content was found out 11.62% in our study, 15.9% in a study made by Mazloomifar et al. (2004) while reported as absent by a third research group (Sefidkon and Najafpour, 2001). On the other hand, limonene in both of previous mentioned studies (Sefidkon and Najafpour, 2001; Mazloomifar, et al., 2004), reached about 8.7% in the oil extracted from aerial parts, whereas according to our study it was not identified as a main component of the oil in plant aerial parts. These differences could be related to the difference in locality as well as to the growth stage of the plant from which samples were initially taken.

CONCLUSION

A comparison of the essential oils from *Prangos uloptera* aerial parts in fresh and dry stages showed that there were quantitative and qualitative differences between the oil in the dry stage and the oil of fresh stage; the variations, yields, and the principal constituting components were different in both stages. β-myrcene and α-pinene as poisonous constituents with harmful biological effects were identified in the oils obtained from *P. uloptera*. The percentages of the mentioned toxic components decreased in dry stage oil.

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Table-1: Percentage composition of the oil of *Prangos uloptera* fresh/dry aerial parts.

Components	R[a](fresh)	R[a](dry)	% in oil (fresh)	% in oil (dry)
α-Pinene	943	937	20.29	13.62
Camphene	959	951	0.48	0.37
Sabinene	979	975	0.87	0.41
β-Pinene	983	979	1.00	0.58
β-Myrcene	995	991	3.89	1.42
α-Phellandrene	1010	-	1.89	-
ortho-Cymene	-[b]	1026	-	0.63
Limonene	-	1031	-	2.44
δ-3-Carene	1038	-	8.03	-
(Z)- β-Ocimene	1043	1038	2.99	0.61
(E)- β-Ocimene	1057	1049	19.64	2.36
γ-Terpinene	1066	-	0.47	-
Terpinolene	1094	-	0.25	-
Linalool	1105	1101	0.74	2.42
6-Camphenol	-	1122	-	2.24
allo-Ocimene	1134	-	0.39	-
cis-Verbenol	1150	-	0.15	-
Trans-Verbenol	1155	1150	0.83	1.68
Borneol	1176	-	0.26	-
neoiso-Isopulegol	-	1182	-	0.24
α-Terpineol	-	1195	-	0.41
trans-Carveol	1214	-	0.34	-
cis-Chrysanthenyl acetate	1268	1265	0.18	1.43
Bornyl acetate	1295	1291	2.06	0.89
δ-Elemene	1348	1344	0.72	0.31
α-Cubebene	1360	-	0.27	-
α-Copaene	1389	1385	0.17	0.40
β-Bourbonene	1399	1396	0.31	1.34
β-Caryophyllene	1440	1435	9.95	13.94
β-Gurjunene	1446	1441	0.34	0.38
α-Humulene	1472	1467	1.83	2.46
ar-Curcumene	-	1489	-	1.58
Germacrene D	1501	1495	6.02	4.73
α-Zingiberene	1506	1501	1.52	0.48
Bicyclogermacrene	1515	1509	2.17	1.25
β-Bisabolene	-	1514	-	0.48
β- Sesquiphellandrene	1536	1531	2.14	1.42
Kessane	1548	1544	0.19	2.30
Spathulenol	1599	1582	1.11	7.79
Caryophyllene oxide	1605	1603	1.17	11.62
Salvial-4(14)-en-1-one	-	1611	-	0.71
Humulene epoxide II	1631	1627	0.15	2.01
Dill apiole	1638	1634	0.33	0.78
Caryophylla-4(14),8(15)-dien-5.alpha-ol	-	1650	-	1.84
(Z)-α-Santalol	-	1689	-	1.36
α-Bisabolol	-	1695	-	0.96
Eudesma-4(15),7-dien-1-beta-ol (impure)	-	1703	-	2.47

[a] R: Relative index; [b] -: absent