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Chemical Composition of Essential Oil Extracted from Syrian Juniper Berries (*Juniperus drupacea* L.)

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ABSTRACT

Oil-bearing juniper berry is a major commercial species used for essential oil production in Syria. This study was conducted at Damascus University in Syria aiming at investigating qualitative variation within Syrian juniper berries (*Juniperus drupacea*). The fruits of three accessions of Syrian juniper berries were collected across major and minor juniper areas in Syria (Slonfa, Makamat and Jobbelahmar) in two different times (ripe fruits and unripe fruits). Gas chromatography/mass spectrometry analysis of oil extracted from each accession's fruits identified the main components of essential oil such as: α-Pinene (1-48%), δ-Cadinene (6-13%), Germacrene D (3-17%) and γ-Cadinene (1-8%). Besides, many trace compounds were detected such as: Camphene, β-Pinene, β Myrcene, totarol and Caryophyllene oxide. The essential oil of Slonfa accession's ripe fruits had shown the highest quality.

Key words: Syrian juniper berry, essential oil, fruits, chemical composition

INTRODUCTION

One of the important *Juniperus* species is Syrian juniper berry "*Juniperus drupacea*" which is commercially used for essential oil production in Syria (Alrefai *et al*., 2003). It is native to Syrian Arab Republic growing on rocky sites from 800-1700 m altitude (Fandi *et al*., 2012). It is a tree with conic crown, thick brown bark, three-sided branches with prominent ridges, one-year shoots greenish and two-year ones brown and needle-like leaves (Karaca, 1994) (Fig. 1). It was used by ancient Egyptians in medicine and preservation the dead human tissues (Karaman *et al*., 2003). Miceli *et al*. (2011) indicated that *J. drupacea* has applications in traditional medicine as anthelmintic, to treat stomachache and against hemorrhoids. Decoction of fresh shoots is used for urinary inflammations, gout and to treat abdominal pain (Akkol *et al*., 2009). El-Ghorab *et al*. (2008) suggest that this fruit could be a natural antioxidant supplement for foods and beverages. Previous studies have studied different species of *Juniperus* and identified the chemical composition of their essential oils (Vourlioti-Arapi *et al*., 2012; Orav *et al*., 2010). The chemical composition of Syrian juniper oil is one of the most complexes and contains more than 300 known compounds, yet the main chemical components can be listed as pinene, cadinene and germacrene. According to the big climatic differences of the areas in which accessions of Syrian juniper exist in Syria, this investigation was conducted to examine the qualitative variation within them and to determine the best time of fruit collecting.

Fig. 1: Morphology of Syrian juniper berry tree

MATERIALS AND METHODS

Three accessions of *Juniperus drupacea* were examined. The fruits were collected from the trees of three sites located in two regions of Syria's. They were (Almakamat and Slonfa) in Latakia and (Jobbelahmar) in Hama (Fig. 2). Ripe and unripe fruits of each accession were extracted by using Clevenger in two dates (July and October) (Fig. 3). Then, 20 μL of essential oil was analyzed using gas chromatography/mass spectrometry GC/MS (Vourlioti-Arapi *et al.*, 2012) in three replications following these parameters: Injection temperature: 240°C, Flow: 10 psi, Ionization mode: EI (70 eV), Oven program: 60 up to 240°C, Gas: Helium, Column: Cp W AX 52 CB m* 10.32 mm, 1.2 μm and Library: Wiley, Nist, Tutor. The analysis results were analyzed statistically using LSD (Least Significant Difference) by the statistical program marked as SPSS. Duncan test was also used to compare mean averages. GC/MS software was used to draw the chromatograms for each studied accession.

RESULTS

Table 1 shows that four components, representing 11-86% of the oil, were characterized. α-pinene (1-48%), δ-cadinene (6-13%), Germacrene D (3-17%) and γ-cadinene (1-8%) were found to be major constituents. It also shows the qualitative variation within the accessions investigated. No significant differences in their content of trace elements. In contrary, Slonfa accession was significantly superior to others in its content of α-pinene in both ripe fruits (47.68%) and unripe fruits (29.72%). It was also significantly superior in its low content of (Germacrene-D) and (δ-cadinene) to other accessions. Ripe fruits were superior to unripe fruits in their content of α-pinene (47.68%) and their lower content of (Germacrene-D) (3.53%) and (δ-cadinene) (2.33%) (Fig. 4). It was noticeable that the berries of Slonfa, even the unripe fruits, were superior to the ripe fruits of Jobbelahmar in their content of the major constituent (α-pinene).

Fig. 2: Studied areas of Syrian juniper in syria

Fig. 3(a-e): Extracting of essential oil from Syrian juniper berries, (a) Fruit collecting, (b) Grinding, (c) Meshing, (d) Distilling and (e) Oil collecting

Table 1: Percentage of essential oil components for each investigated accession

	Accession (Area)					
	Jobbelahmar		Slonfa		Makamat	
Compound (%)	Unripe fruits	Ripe fruits	Unripe fruits	Ripe fruits	Unripe fruits	Ripe fruits
α-pinene	3.12	17.55	*29.72	**47.68	22.43	*39.50
Camphene	0.44	0.21	0.35	1.46	0.24	0.57
β-oinene	*2.94	1.76	*2.28	**4.52	1.31	*2.17
β myrcene	*4.00	2.12	3.52	**5.09	2.50	2.83
α-terpinolene	0.76	0.58	1.35	1.38	0.76	0.73
Terpinen-4-ol	0.18	0.33	0.39	0.24	0.51	0.70
α-cubebene	2.44	1.42	0.91	1.86	0.00	0.95
a-ylangene	1.08	0.75	0.22	0.64	0.37	0.35
α copaene	*2.72	*2.88	1.31	**3.49	1.80	1.85
β-caryophyllene	3.92	2.89	1.06	2.10	2.00	1.45
β copaene	1.52	1.99	0.56	1.57	1.02	0.70
α-humulene	1.53	2.53	0.83	1.51	1.71	0.52
Germacrene D	16.75	11.75	*5.10	**3.53	8.00	8.48
γ-muurolene	0.28	0.21	0.00	0.00	3.20	0.88
β-selinene	0.33	0.33	0.13	0.22	0.88	0.49
γ-cadinene	7.58	6.55	1.78	**3.94	3.32	2.13
Calamenene	0.87	0.86	0.13	0.26	0.39	0.35
δ-cadinene	12.50	9.37	6.12	**2.33	4.68	*2.76
β-germacrene	0.67	0.00	0.14	0.31	0.37	0.14
Caryophyllene oxide	0.31	0.60	0.07	0.19	0.25	0.09
Tau-cadinol	0.66	0.94	0.09	0.22	0.16	0.09
Abietatriene	0.86	0.00	0.23	0.57	1.72	0.53
Totarol	1.74	4.46	0.51	1.38	2.71	0.13
Ferruginol	0.15	0.79	0.00	0.30	0.21	0.09

*Significant at 95%, **Significant at 99%

DISCUSSION

The accessions used for Syrian berries' oil production are genetically related and perhaps the same accession is used in several countries such as Turkey (Alrefai *et al*., 2003), Lebanon and Syria (Fandi *et al*., 2012). This accession is being used for essential oil production in Syria (Hama and Latakia). The genetic relations might explain the qualitative variation noticed within the accessions. But, the qualitative variation between Slonfa accession on one hand and Jobbelahmar and Almakamat accessions on the other hand could not be explained genetically (Fandi *et al*., 2012). Otherwise, agro-ecological variation should be considered. The high percentages of main components of Syrian berries' oil are considered as a positive quality parameter. Contradictory, another positive quality parameter is the low content of (Germacrene-D) and (δ-cadinene) (Orav *et al*., 2010) which was noticed in Slonfa accession.

CONCLUSION

This study showed for the first time the composition of essential oil of Syrian juniper berries' fruits in Syria. GC/MS analysis indicated that different accessions have qualitative differences in composition of essential oil. The essential oil of Slonfa accession's ripe fruits had got the highest quality.

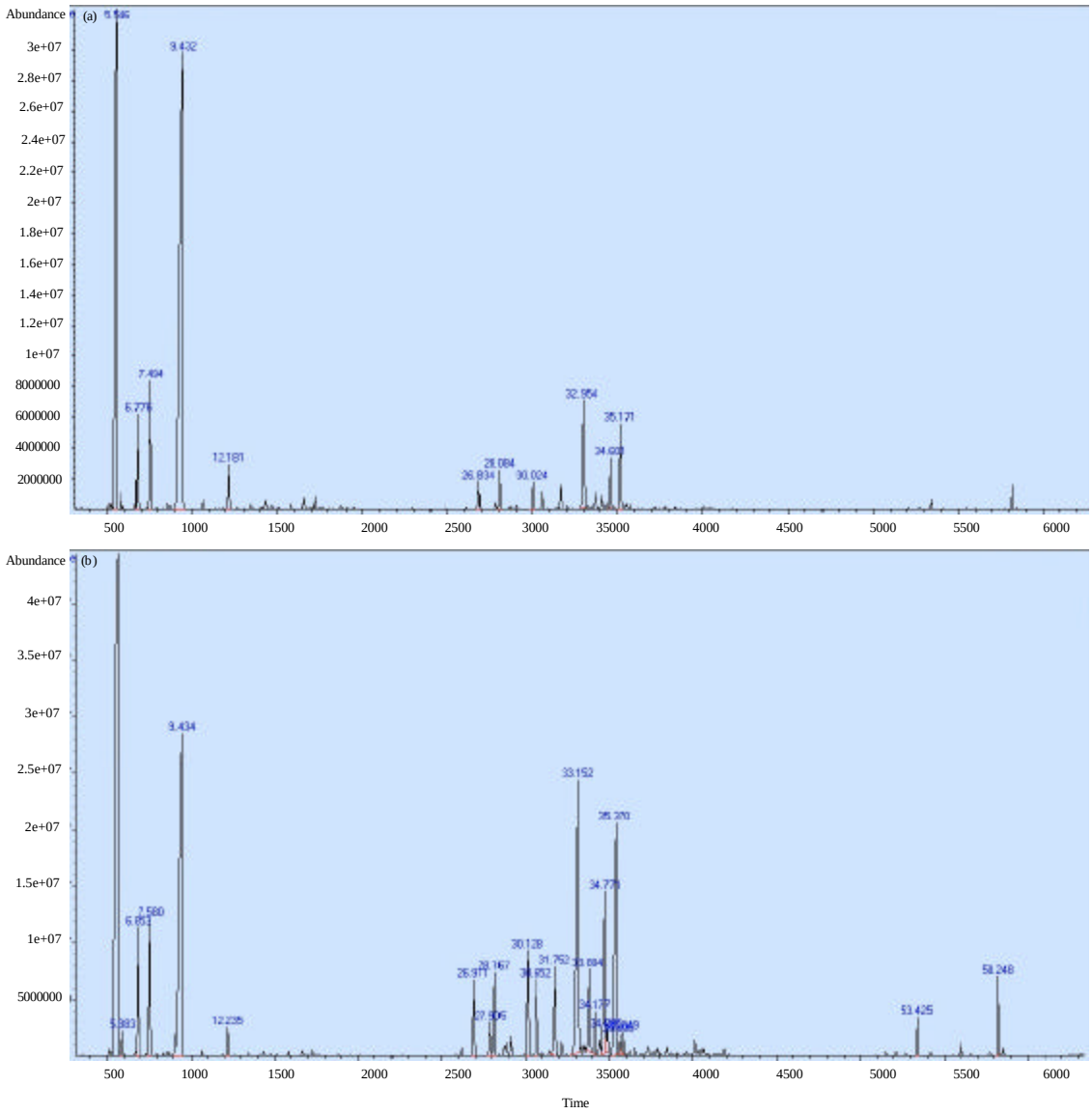

Fig. 4(a-b): Chromatograms of ripe and unripe berries, (a) Ripe fruits and (b) Unripe fruits

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