

ESSENTIAL OIL COMPOSITION OF *Acinos graveolens* FROM IRAN

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Acinos Miller (Lamiaceae) is represented by 10 species distributed over Mediterranean regions toward Central Asia and Iran [1], and some of them are traditionally used in Mediterranean countries [2]. In Iran, two species of this genus exist, *Acinos arvensis* (Lam.) Dandy and *A. graveolens* (M. B.) Link. *Acinos graveolens* is an annual, dwarf herb which is widely distributed in Iran and neighboring countries [3]. This is the first report on the chemical composition of this species.

In Table 1, data on constituents of this species are given. Sesquiterpenes as the first major class of compounds constituted 47.9% of the total oil, and phenolics with a predominance of dillapiole (32.7%), the first major compound of the oil, were the second main group of structures (35.5%). Monoterpenes only composed 10.4% of the total oil. Germacrene-D, the second major compound of *A. graveolens* oil (16.5%), was also a major compound in the oil of *A. arvensis* [4–6], *A. hungaricus* (Simonkai) Silic [7], *A. alpinus* (L.) Moench. [8–10], and two subspecies of *A. troodi* (Post) Leblebici [11]. Pulegone, which was a major constituents in the oil of *A. suaveolens* (Sibth. et Sm.) G. Don f. [5, 12] and *A. arvensis* [5], was not detected in this oil. Caryophyllene type compounds, also a main class of constituent in the oil of *A. arvensis* [4], *A. alpinus* [8], and *A. hungaricus* [13], composed 7.2% of the oil of this work, and hexadecanoic acid, a main compound in the oil of *A. arvensis* [5], *A. alpinus* [9], and *A. troodi* [11], only constituted 0.9% of the total oil of this work.

Plant Material and Isolation Procedure. The aerial parts of *Acinos graveolens* were collected in May 2007 at the full flowering stage from Dasht-e Arjan in Fars province of Iran. A voucher specimen has been deposited in the herbarium of Shiraz University, Department of Botany (Collector Number: PC86-28). The aerial parts of the specie were air-dried. The oil was obtained by hydrodistillation using a cleveger-type apparatus for 4 h. The yield of oil was 0.01% (w/w), and the color of the oil was pale blue. It was dissolved in *n*-hexane (Merck), dried over anhydrous sodium sulfate, and stored at 4–6°C.

Identification of the Oil Components. GC analysis was carried out using a Varian GC 3600 chromatograph with a DB-5 column (30 m × 0.25 mm; 0.25 μm film thicknesses). The oven temperature was increased from 60–240°C at 3°C/min, and the injector and detector temperatures were 240°C and 250°C, respectively. Quantitative data were obtained from electronic integration of peak areas without the use of correction factors.

GC/MS analysis was carried out using a Hewlett-Packard 6890 machine operating at 70 eV ionization energy, equipped with a HP-5 capillary column (phenyl methyl siloxane, 30 m × 0.25 mm; 0.25 μm film thicknesses) with He as the carrier gas and a split ratio of 1:20. Retention indices were determined by using the retention times of *n*-alkanes that had been injected after the oil under the same chromatographic conditions. The retention indices for all the components were determined according to the Van Den Dool method using *n*-alkanes as standard [14]. The compounds were identified by comparison of their retention indices (RRI, HP-5) with those reported in the literature and by comparison of their mass spectra with the Wiley and Mass finder 3 libraries or with the published mass spectra [15, 16].

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TABLE 1. Constituents of the Essential Oil of *Acinos graveolens*

Compound	RI	%	Compound	RI	%
α -Thujene	927	0.3	β -Caryophyllene	1418	3.3
α -Pinene	934	0.4	β -Copaene	1430	0.3
Sabinene	973	0.1	α -Humulene	1454	0.3
Dehydro-1,8-cineole	990	Tr.	(<i>E</i>)- β -Farnesene	1456	1.4
(<i>E,E</i>)-2,4-Heptadienal	1012	0.2	Germacrene-D	1483	16.5
<i>p</i> -Cymene	1025	Tr.	γ -Humulene	1489	3.1
Limonene	1026	0.2	β -Selinene	1491	3.1
1,8-Cineole	1030	Tr.	Valencene	1496	1.2
Acetophenone	1066	2.3	γ -Cadinene	1514	1.8
γ -Terpinene	1058	Tr.	δ -Cadinene	1524	4.9
<i>cis-p</i> -Menth-2-en-1-ol	1120	0.4	<i>trans</i> -Cadin-1,4-diene	1533	0.3
α -Campholenal	1126	Tr.	α -Cadinene	1539	1.1
<i>trans</i> -Chrysanthenol	1147	1.2	α -Calacorene	1544	0.3
Pinocarvone	1165	Tr.	β -Caryophyllene oxide	1549	0.3
Terpinen-4-ol	1175	4.1	Caryophyllene oxide	1583	3.6
α -Terpineol	1190	1.2	1,10-Diepieubenol	1618	0.7
Verbenone	1208	0.5	Dillapiole	1621	32.7
<i>trans</i> -Chrysanthenyl acetate	1235	1.4	α -Muurolol	1645	0.7
<i>cis</i> -Chrysanthenyl acetate	1264	0.3	α -Cadinol	1653	1.6
Perilla aldehyde	1271	Tr.	6,10,14-Trimethyl-2-pentadecanone	1845	0.8
Isopulegyl acetate	1279	0.3	Hexadecanoic acid	1976	0.9
Eugenol	1359	0.5	Total		96.4
α -Ylangene	1373	0.7	Monoterpenes		10.4
β -Bourbonene	1383	1.6	Sesquiterpenes		47.9
β -Elemene	1390	1.5	Phenolics		35.5
(<i>Z</i>)-Jasmone	1395	0.3	Aliphatic hydrocarbons		1.9
Methyl eugenol	1405	Tr.			

RI: retention indices relative to C₈-C₂₈ *n*-alkanes on HP₅. The components are listed in order of elution from the HP-5 column.

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