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Chemical Composition of the Essential Oil of *Salvia nemorosa* using Gas chromatography Mass spectroscopy

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ABSTRACT: The water-distilled essential oil produced from the aerial parts of *Salvia nemorosa*, endemic in Iran, was analyzed by GC/MS. Fifteen compounds were identified representing 92.46% of the total components detected with β-Caryophyllene (18.7%), Isocaryophillene (6.8%) and Caryophyllene oxide (5.2%) as the major constituents.

***Keywords*:** *Salvia nemorosa*, Lamiaceae, β-Caryophyllene, Isocaryophillene, Caryophyllene oxide.

INTRODUCTION

The genus Salvia (Lamiaceae) is comprised of about 700 herbs and shrubs, growing in the temperate and warmer zones of the world. Fifty-eight species are found in Iran, 17 of which are endemic (Rechinger, K.H. 1982 and Longaray A. P. et. al., 2007) Salvia officinalis (sage) is one of the most widespread species and is known over the world from oldest times as a spice, condiment and for its medicinal value (Philipps, R., 1987). The most well-known species are common sage (Salvia officinalis L.), tailored sage (Salvia fruticosa Mill.), and Spanish sage (Salvia lavandulifolia Vahl) (Raal. A 2007) Sage is largely used as a savory food flavoring either as dried leaves or essential oil (Perry N.B. 1999). Sage leaves and its essential oil possess carminative, antispasmodic, antiseptic, astringent, and antihidrotic properties (Raal, A 2007). The predominant medicinally valuable metabolites are monoterpenes (e.g., - and -thujone, 1,8-cineole, camphor), diterpenes (e.g., carnosic acid) triterpenes (oleanoic and ursolic acids), and phenolic compounds like rosmarinic acid(Cuvelier M.E 1999 and Lamaison J.L 1994). Environmental conditions such as temperature, day length, and light influence quantitative compositions of essential oils (Figueiredo A.C. 2008). These conditions change significantly and predictably during the vegetation period, leading to a pattern of seasonal variation in plant metabolites, that is, generally repeated every year. In Salvia, the major monoterpenes 1,8-cineole, camphor, and the two thujones show pronounced dynamics during a vegetative cycle that has been confirmed under different geographical conditions (Marie S., 2006 and Pinto E., 2007). According to Grausgruber-Gröger et al. 2012 1,8-cineole steadily decreases during a vegetative period (approx. May to October), camphor peaks in the middle of the vegetative period, and - and -thujone increase gradually during the vegetative period.

EXPERIMENTAL

Aerial parts of the plant were collected from the Zagruse mountain in south west of Iran in May 2010, at flowering. Dried aerial parts (100g) were water distilled for 3 h using a Clevenger-type apparatus to obtain oil in 0.6% w/w yield.

Gas chromatography–Mass spectroscopy

GC/MS analysis of the oil was carried out on an Agilent HP-6890 gas Chromatograph (Agilent Technologies, Palo Alto, CA, USA) equipped with an Agilent HP-5973 mass selective detector in the electron impact mode (ionization energy: 70eV), operating under the same conditions as described above, using a HP-5MS 5% phenylmethylsiloxane capillary column (30 m × 0.25 mm, 0.25 µm film thickness; Restek, Bellafonte, PA). Retention indices were calculated for all components using a homologous series of n-alkanes injected in conditions equal to

the sample one. Identification of components of essential oil was based on retention indices (RI) relative to n-alkanes and computer matching with the Wiley7 libraries, as well as comparisons of the fragmentation pattern of the mass spectra with data published in the literatur (Adams, P.R., 2004) Some commercially available components of the essential oil were also co-injected for further confirmation of their identification.

Table 1. Composition of the essential oil of *Salvia nemorosa* from Iran
RI:Kovats Constant , in flowering stage

No	Compound	RI	%
1	Limonene	1092	1.34
2	Ocimene	1050	1.72
3	α.-Terpinolene	1060	2.87
4	Isocaryophillene	1419	6.8
5	β-Caryophyllene	1425	18.7
6	Germacrene-D	1485	0.32
7	Gurjunene	1434	3.4
8	δ-Cadinene	1523	3.9
9	Nerolidol	1563	2.6
10	Spathulenol	1578	0.59
11	Caryophyllene oxide	1583	5.2
12	γ.-Gurjunene	1477	2.4
13	Aromadendrene	1441	0.22
14	Longifolene	1569	4.9
15	Benzyl benzoate	1760	0.7

RESULTS AND DISCUSSION

The results of the GC/MS analysis of the oil of S. nemorosa are listed in Table I. Among the 15 compounds identified β-Caryophyllene (18.7%), Isocaryophillene (6.8%) and Caryophyllene oxide (5.2%) as the major constituents. Comparing these results with previous works on Salvia species revealed that in contrast to the oil of S. nethiopis, S. hypoleuca and S. Hydrangea(Sefidkon, F.,etr. Al., 1999) in S. nemorosa oil monoterpenes predominated over sesquiterpenes, the same as S. multicaulis and S. sahendica oil(Rustaiyan, A 1987).

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