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RESEARCH ARTICLE

Essential oil composition of *Stachys iberica* Bieb. subsp. *iberica* from Turkey.

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Abstract

Air dried aerial parts of *Stachys iberica* subsp. *iberica* were subjected to water-distillation using a Clevenger-type system. The resulting essential oil was analysed by GC-FID and GC-MS, simultaneously. Overall, thirty components were characterized. Hexadecanoic acid (41.5%), %), phytol (8.2%) and germacrene D (9.7%) were characterized as major constituents.

Keywords: *Stachys iberica,* GC-FID/GC-MS, hexadecanoic acid

Introduction

The family Lamiaceae has a cosmopolitan distribution with highly varied morphological characters. The family comprises about 236 genera and 7200 species in the world (Govaerts et al, 2011). The Lamiaceae members are common especially in the mountainous areas of the South parts of Turkey. Their essential oil compositions were previously detailed by one of us (Baser 1993, Baser 1994). Aerial parts of most Lamiaceae plants are used as a spice because of their aromatic properties and are often consumed as herbal tea (Atoui et al, 2005).

Stachys is one of the largest genera of Lamiaceae containing 300 species throughout the world 116 taxa growing in Turkey and 55 of which are endemic (Raduloviç et al 2007, Dündar et al, 2013, Baştürk et al, 2015).

Some *Stachys* species are used as tonic and stomachic in Anatolia. *S. inflata* extracts obtained from the non-flowering aerial parts have been used in Iranian folk medicine for the treatment of infective, asthmatic and rheumatic disorders. Whole plant or leaves are used in phytotherapy due to sedative, antispasmodic and diuretic properties in tea preparations (Duman et al, 2005).

In the present work, the aerial parts of *S. iberica* Bieb. subsp. *iberica* were hydrodistilled for 3 h using a Clevenger-type apparatus and analysed by GC-FID and GC/MS techniques, simultaneously.

Materials and Methods

Plant Material

S. iberica subsp. *iberica* was collected in June, 2008 in Eskişehir, Çatacik, 39°57'44", 31°05'21" at an altitude 1652 m (voucher specimen code: Baser 1838). Botanical identification was carried out one of us (HD).

Isolation of the Essential Oil

The air dried herb was water distilled for 3 h using a Clevenger-type apparatus to produce essential oil in 0.04% yield. Chemical composition of the essential oil is shown in Table 1.

GC/MS Analysis

The GC/MS analysis was carried out using an Agilent 5975 GC-MSD system. Innowax FSC column (60 m x 0.25 mm, 0.25 μm film thickness) was used with helium as carrier gas (0.8 ml/min). GC oven temperature was kept at 60°C for 10 min and programmed to 220°C at a rate of 4°C/min, and kept constant at 220°C for 10 min and then programmed to 240°C at a rate of 1°C/min. Split ratio was adjusted at 40:1. The injector temperature was set at 250°C. Mass spectra were recorded at 70 eV. Mass range was from m/z 35 to 450. *n*-Alkanes were used as reference points in the calculation of the relative retention indices (RRI).

GC-FID Analysis

The GC analysis was carried out using an Agilent 6890N GC system. FID detector temperature was 300°C. To obtain the same elution order with GC/MS, simultaneous auto-injection was done on a duplicate of the same column applying the same operational conditions. Relative percentage amounts (%) of the separated compounds were calculated from FID chromatograms. The result of the analysis is shown in Table 1.

Identification of Components

Identification of the essential oil components was carried out by comparison of their relative retention times with those of authentic samples or by comparison of their relative retention indices (RRI) to series of *n*-alkanes. Computer matching against commercial libraries (McLafferty and Stauffer, 1989; Koenig et al, 2004) and in-house "Başer Library of Essential Oil Constituents" built up by genuine compounds and components of known oils was performed. Additionally, MS literature data (Joulain and Koenig, 1998; ESO 1999) was also used for the identification of components.

Results and Discussion

Water distilled essential oil was analysed both by GC and GC-MS systems, simultaneously. Thirty compounds comprising 95% of the oil with hexadecanoic acid (41.5%), phytol (8.2%) and germacrene D (9.7%) were characterized as major constituents in the oil of *S. iberica* subsp*. Iberica*.

Table 1. Chemical composition of *S. iberica* subsp*. iberica* essential oil

RRI	Compounds	%
1032	α -Pinene	0.5
1118	β -Pinene	0.4
1132	Sabinene	0.7
1203	Limonene	1.0
1218	β -Phellandrene	0.2
1246	(*Z*)- β -Ocimene	0.2
1553	Linalool	tr
1612	β -Caryophyllene	3.7
1659	γ Gurjunene	0.4
1668	(*Z*)- β-Farnesene	1.4
1687	α -Humulene	tr
1709	α -Terpinyl acetate	0.5
1726	Germacrene D	9.5

1755	Bicyclogermacrene	2.9
1771	γ-Bisabolene	0.6
1868	(*E*)-Geranyl acetone	0.8
1958	(*E*)- β -Ionone	0.8
2008	Caryophyllene oxide	1.5
2131	Hexahydrofarnesyl acetone	2.9
2144	Spathulenol	1.6
2179	3,4-Dimethyl-5-pentylidene-2(5H)-	0.5
2384	Hexadecanol	1.8
2400	Tetracosane	0.4
2503	Dodecanoic acid	1.2
2607	1-Octadecanol	0.9
2622	Phytol	7.8
2670	Tetradecanoic acid (=Myrsitic acid)	4.0
2700	Heptacosane	1.4
2822	Pentadecanoic acid	1.2
2900	Nonacosane	4.2
2931	Hexadecanoic acid	41.9
	Total	**94.9**

RRI: Relative retention indices calculated against *n*-alkanes,
%: percentages were calculated from FID data, tr Trace (< 0.1 %)

According to previous research report by our group, the chemical composition of *S. iberica* subsp *stenostachya* essential oil from Turkey showed linalyl acetate (42.2%), linalool (18.9%), geranyl acetate (8.2%), and α-terpineol (5.3%) as the main constituents (Kaya et al, 2001). It clearly show that the oil compositions of two taxa are different.

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