

## ESSENTIAL OILS OF TWO *Hypericum* SPECIES FROM UZBEKISTAN\*

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UDC 547.913+543.51

*The water-distilled essential oils from aerial parts of two Hypericum species (Hypericaceae) have been analyzed by GC/MS. The main components of the essential oils of Hypericum scabrum L. were  $\alpha$ -pinene - 11.2%; spathulenol - 7.2%; p-cymene - 6.1%; acetophenone - 4.8%; carvacrol - 4.7%. The essential oil of Hypericum perforatum L. contains as the main components  $\beta$ -caryophyllene - 11.7%; caryophyllene oxide - 6.3%; spathulenol - 6.0%;  $\alpha$ -pinene - 5.0%.*

**Key words:** *Hypericum scabrum*, *Hypericum perforatum*, essential oil, GC/MS.

*Hypericum* (Hypericaceae) species have been used for a long time in folk medicine. In recent years *H. perforatum* has been the ingredient of modern medicines for the treatment of mild depression. The essential oil of *H. perforatum* has previously been investigated [1-5]. In a recent study [3],  $\alpha$ -pinene (61.7%) was reported as the main constituent of the oil in the plant material of Turkish origin. *Hypericum perforatum* L. is included in the Pharmacopoeias of Russia, Chekhiya, Romania, Poland, and France [4]. In Uzbekistan, a skin remedy is prepared from ashes of its herbal parts. It is used as an antihelminthic in veterinary medicine.

The yield and physicochemical properties and oil composition of *Hypericum scabrum* L. of Turkish origin has previously been reported [3, 6]. It was found to contain  $\alpha$ -pinene (71.6%) as the main constituent [3].

Here we report our results on the essential oil composition of *H. scabrum* and *H. perforatum* from Uzbekistan. *H. scabrum* collected in Khisor mountain in the Kashkadar'ya region of Uzbekistan yielded 0.2% essential oil and *H. perforatum* collected in Nanai village in Chimgan mountains in Tashkent region yielded 0.1% essential oil. The composition of the oils is given in Table 1.

A total of 104 and 106 components were characterized representing 85.9% and 89.6% of the essential oils in *H. scabrum* L. and *H. perforatum* L., respectively.  $\alpha$ -Pinene (11.2%), spathulenol (7.2%), p-cymene (6.1%), acetophenone (4.8%), carvacrol (4.7%) were the main constituents of the essential oil of *H. scabrum*. The main components of the essential oil of *H. perforatum* were  $\beta$ -caryophyllene (11.7%), caryophyllene oxide (6.3%), spathulenol (6.0%),  $\alpha$ -pinene (5.0%).

Caryophyllene and pinene rich oils of *H. perforatum* have been reported [1-5]. Our results are in agreement with the results reporting sesquiterpenes as the main constituents [1].

\*Presented at the 4th International Symposium on the Chemistry of Natural Compounds (SCNC), 6-8 June 2001, Isparta, Turkey.

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TABLE 1. The Composition of the Essential Oil of *Hypericum* Species

RRI	Compound	A, (%)	B, (%)	RRI	Compound	A, (%)	B, (%)
965	3-Methylnonane	-	0.1	1628	Aromadendrene	0.6	0.6
1032	$\alpha$ -Pinene	<b>11.2</b>	<b>5.0</b>	1638	<i>cis-p</i> -Menth-2-en-1-ol	0.1	-
1065	2-Methyldecane	-	0.2	1648	Myrtenal	1.1	0.1
1076	Camphene	0.2	-	1668	(Z)- $\beta$ -Farnesene	-	1.8
1093	Hexanal	Tr.	-	1671	Acetophenone	<b>4.8</b>	-
1100	Undecane	0.3	0.2	1674	<i>p</i> -Mentha-1,5-dien-8-ol	0.6	0.1
1118	$\beta$ -Pinene	0.4	0.9	1683	<i>trans</i> -Verbenol	1.6	0.2
1174	Myrcene	0.1	0.5	1687	$\alpha$ -Humulene	-	0.6
1188	$\alpha$ -Terpinene	0.2	Tr	1700	<i>p</i> -Mentha-1,8-dien-4-ol	0.3	-
1203	Limonene	0.9	0.6		(limonen-4-ol)		
1213	1,8-Cineole	0.1	Tr.	1704	$\gamma$ -Muurolene	1.1	3.6
1218	$\beta$ -Phellandrene	-	Tr.	1706	$\alpha$ -Terpineol	0.7	-
1224	<i>o</i> -Mentha-1(7),5,8-triene	0.1	-	1711	$\gamma$ -Himachalene	-	0.1
1225	(Z)-3-Hexenal	0.2	-	1719	Borneol	1.5	-
1244	Amylfuran(2-pentylfuran)	Tr.	Tr.	1725	Verbenone	2.7	-
1246	(Z)- $\beta$ -Ocimene	-	0.1	1726	Germacrene D	0.4	2.2
1255	$\gamma$ -Terpinene	0.9	0.2	1740	$\alpha$ -Muurolene	1.1	-
1266	(E)- $\beta$ -Ocimene	-	0.7	1742	$\beta$ -Silenene	-	1.8
1280	<i>p</i> -Cymene	<b>6.1</b>	0.2	1744	$\alpha$ -Silenene	-	1.8
1290	Terpinolene	0.2	0.1	1751	Carvone	0.3	-
1296	Octanal	Tr.	-	1755	Bicyclogermacrene	-	0.2
1391	(Z)-3-Hexenol	-	Tr.	1758	(E,E)- $\alpha$ -Farnesene	-	0.1
1398	2-Nonanone	0.1	-	1764	(E)-2-undecenal	-	0.3
1400	Nonanal	0.1	0.4	1766	Decanol	0.2	-
1439	$\gamma$ -Campholene aldehyde	0.4	0.1	1773	$\delta$ -Cadinene	1.0	2.1
1441	(E)-2-Octenal	-	0.1	1776	$\gamma$ -Cadinene	1.2	2.0
1451	$\beta$ -Thujone	0.1	-	1797	<i>p</i> -Methyl acetophenone	0.4	-
1466	$\alpha$ -Cubebene	-	0.1	1798	Methyl salicylate	-	Tr.
1467	6-Methyl-5-hepten-2-ol	0.1	-	1804	Myrtenol	1.1	0.4
1478	<i>cis</i> -Linalool oxide (furanoid)	Tr.	-	1810	3,7-Guaiadiene	-	0.3
1479	(E,Z)-2,4-Heptadienal	Tr.	-	1815	2-Tridecanone	Tr.	-
1493	$\alpha$ -Ylangene	-	0.2	1827	(E,E)-2,4-Decadienal	0.1	0.1
1496	3-Nonanol	Tr.	-	1845	<i>trans</i> -Carveol	1.4	0.1
1497	$\alpha$ -Copaene	-	0.7	1853	<i>cis</i> -Calamenene	-	0.7
1499	$\alpha$ -Campholene aldehyde	2.3	0.5	1857	Geraniol	-	0.1
1503	Isomenthone	-	0.6	1864	<i>p</i> -Cymen-8-ol	2.3	-
1521	2-Nonanol	0.1	-	1868	(E)-Geranyl acetone	0.1	0.2
1532	Camphor	1.3	0.1	1882	<i>cis</i> -Carveol	0.1	-
1535	$\beta$ -Bourbonene	0.2	0.1	1896	<i>cis-p</i> -Mentha-1(7),8-diene-2-ol	Tr.	-
1548	(E)-2-Nonenal	-	0.2	1902	Benzyl isovalerate	-	0.1
1553	Linalool	0.3	0.2	1929	2-methyl butyl benzoate	-	0.1
1562	Isopinocampnone	0.1	-	1941	$\alpha$ -Calacorene	0.9	0.6
1562	Octanol	-	0.1	1945	1,5-Epoxy-salvial(4)14-ene	0.1	0.4
1565	Linalyl acetate	-	Tr.	1958	(E)- $\beta$ -Ionone	-	0.2
1571	<i>trans-p</i> -Menth-2-en-1-ol	Tr.	Tr.	1969	<i>cis</i> -Jasmone	-	0.1
1586	Pinocarvone	0.7	0.2	1973	Dodecanol	0.2	1.4
1587	$\beta$ -Funebrene	-	1.1	1981	Heptanoic acid	0.2	-
1591	Fenchyl alcohol	0.5	-	1984	$\gamma$ -Calacorene	0.2	0.1
1599	(E,Z)-2,6-Nonadienal	0.1	-	1988	2-Phenylethyl-2-methyl-butyrate	-	Tr.
1602	6-Methyl-3,5-heptadien-2-one	0.1	-	2001	Isocaryophyllene oxide	0.9	-
1611	Terpinen-4-ol	0.9	0.4	2008	Caryophyllene oxide	0.1	<b>6.3</b>
1612	$\beta$ -Caryophyllene	0.3	<b>11.7</b>	2030	Methyl eugenol	-	0.1

TABLE 1. (Continued)

RRI	Compound	A, (%)	B, (%)	RRI	Compound	A, (%)	B, (%)
2037	Salvial-4(14)-en-1-one	0.6	0.6	2239	Carvacrol	<b>4.7</b>	0.5
2050	(E)-Nerolidol	-	2.2	2245	Elimicine	0.1	-
2057	Ledol	0.2	0.8	2247	<i>trans</i> - $\alpha$ -Bergamotol	0.2	0.3
2071	Humulene epoxide-II	0.2	0.4	2255	$\alpha$ -Cadinol	-	1.3
2077	Tridecanol	-	3.9	2256	Cadalene	1.6	-
2080	Cubenol	0.1	0.3	2273	Selin-11-en-4 $\alpha$ -ol	-	0.5
2084	Octanoic acid	2.4	-	2289	Oxo- $\alpha$ -Ylangene	0.5	-
2088	1- <i>epi</i> -Cubenol	-	0.6	2296	Myristicine	Tr.	-
2098	Globulol	0.5	0.3	2300	Decanoic acid	1.3	0.5
2100	Heneicosane	0.1	-	2300	Tricosane	0.1	-
2104	Viridiflorol	-	0.2	2316	Caryophylla-2(12),6(13)-dien-5 $\beta$ -ol (caryophylladienol I)	0.1	-
2113	Cumin alcohol	0.1	-	2324	Caryophylla-2(12),6(13)-dien-5 $\alpha$ -ol (caryophylladienol II)	-	0.3
2144	Spathulenol	<b>7.2</b>	<b>6.0</b>	2341	(2Z,6E)-Farnesol	-	0.3
2148	(Z)-3-Hexen-1-yl benzoate	-	0.6	2389	Caryophylla-2(12),6-dien-5 $\alpha$ -ol (caryophyllenol I)	0.5	0.4
2179	3,4-Dimethyl-5-pentylidene- 2(5H)-furanone	Tr.	0.2	2392	Caryophylla-2(12),6-dien-5 $\beta$ -ol (caryophyllenol II)	0.3	-
2179	Tetradecanol	-	2.5	2419	4-Isopropyl-6-methyl-1,2,3,4- tetrahydronaphthalen-1-one	0.3	-
2181	Isothymol(2-isopropyl-4-methylphenol)	0.4	-	2503	Dodecanoic acid	1.8	1.2
2187	T-Cadinol	-	0.6	2622	Phytol	-	1.2
2192	Nonanoic acid	0.4	0.3	2655	Benzyl benzoate	0.3	0.3
2198	Thymol	1.2	0.5	2713	Tetradecanoic acid	0.7	1.0
2209	T-Muurolol	0.3	0.5	2931	Hexadecanoic acid	2.8	3.8
2219	$\delta$ -Cadinol	0.1	0.2				
2221	Isocarvacrol	0.1	-				
	(4-isopropyl-2-methylphenol)						
2232	$\alpha$ -Bisabolol	0.1	0.2				
<b>Total</b>						<b>85.9</b>	<b>89.6</b>

A: *Hypericum scabrum*.

B: *Hypericum perforatum*.

RRI: Relative retention indices calculated against *n*-alkanes.

%: calculated from TIC data.

Tr.: Trace (< 0.1%).

## EXPERIMENTAL

The dry aerial parts of the plants were hydrodistilled for 3 h using a Clevenger type apparatus to produce the essential oils. The percentage yields of the oils were calculated on a moisture-free basis.

The essential oils were analyzed by GC/MS using a Hewlett-Packard GCD system. An HP-Innowax FSC column (60 m  $\times$  0.25 mm  $\varnothing$ ) was used with helium as carrier gas. The GC oven temperature was kept at 60°C for 10 min and programmed to 220°C at a rate of 4°C/min, and then kept constant at 220°C for 10 min and programmed to 240°C at a rate of 1°C/min. Alkanes were used as reference points in the calculation of relative retention indices (RRI). The split ratio was adjusted at 50:1. The injector temperature was 250°C. MS were taken at 70 eV. The mass range was from 35 to 425 *m/z*. Library search was carried out using the Wiley GC/MS Library and the TBAM Library of Essential Oil Constituents [7-9]. The relative percentage amounts of the separated compounds were calculated from total ion chromatograms by a computerized integrator.

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