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CHEMICAL CONSTITUENTS OF THE ESSENTIAL OIL OF *Galium mite* var. *roseum ghahramaninejad* FROM IRAN

Sajad Afshaki,[1] Azizolah Jafari,[1] Sara Shahabipour,[2] and Katayoun Javidnia[2]*

The genus *Galium* belongs to the family Rubiaceae. Some species of the genus have been reported to possess antispasmodic, diuretic, and vulnerary effects [1]. Plants of this genus are used for fermenting milk to cheese, and, due to this utility, the plant has been named Shir-panir in Iranian culture. The aerial parts of *Galium* species are also added to different types of food as herb or spice to improve the flavor.

Galium mite var. *roseum ghahramaninejad* is distributed in Turkey, Iraq, Transcaucasus, and Iran. *G. mite* Boiss. & Hohen. and *G. subvelutinum ssp. mite* (Boiss. & Hohen.) Ehrend are the other names for the plant [2]. The chemical constituents of the essential oil of *G. hercynicum*, *G. humifusum*, *G. salicifolium*, and *G. verum* as members of the *Galium* species have been investigated before [3–5]. In the present work, the chemical composition of the essential oil of *G. mite* var. *roseum ghahramaninejad* is reported for the first time. To our knowledge, no previous phytochemical study has been performed on the essential oil of *G. mite* var. *roseum ghahramaninejad*.

The plant material was collected in August 2012 from the Dena region of Iran and identified at the Department of Phytochemistry, University of Yasouj (Iran). Voucher specimens were deposited at the Herbarium of the Yasouj University, Yasouj, Iran (No. HYU25517).

The aerial parts were air-dried at ambient temperature in the shade and hydrodistilled using a Clevenger-type apparatus for 4 h. The essential oil was obtained from the aerial parts of *G. mite* var. *roseum ghahramaninejad* as a yellow liquid in 0.1% (w/w) yield. The essential oil was analyzed by GC-MS (60–240°C at 3°C/min rate) in an Agilent Technology 7890A GC coupled to a 5975C-MS instrument using an HP-5MS capillary column (phenyl methyl siloxane, 30 m × 0.25 mm; 0.25 μm film thickness). The injector temperature was 240°C; injection was in the split mode (1:50). Helium was used as carrier gas at a flow rate of 0.9 mL/min. MS spectra were obtained using electron impact at 70 eV with a scan interval of 0.5 s and mass range from 35 to 550 *m/z*.

The GC/MS analysis of the essential oil resulted in 38 compounds, making up 87.4% of the total composition. The most abundant constituent of the oil was borneol (18.0%), followed by aliphatic aldehydes, including *n*-nonanal (7.5%), (2*E*)-undecanal (7.0%), and (2*E*,4*E*)-decadienal (6.1%). According to Table 1, the volatile oil contained 12 aldehydes (42.1%), eight oxygenated monoterpenes (26.6%), five ketones (8.6%), three oxygenated sesquiterpenes (3.5%), six alkanes (2.2%), and three sesquiterpenes (1.8%).

Unlike other reported species of *Galium* genus, the essential oil of *G. mite* var. *roseum ghahramaninejad* contained significant amounts of aliphatic aldehydes.

1) Department of Phytochemistry, Faculty of Science, Yasouj University, P. O. Box: 75914-353, Yasouj, Iran; 2) Medicinal and Natural Products Chemistry Research Center, Shiraz University of Medical Sciences, P. O. Box: 71345-3388, Shiraz, Iran, fax: 98 711 2332225, e-mail: mncrc@sums.ac.ir; kjavidnia@gmail.com. Published in *Khimiya Prirodnykh Soedinenii*, No. 5, September–October, 2014, pp. 798–799. Original article submitted January 29, 2013.

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TABLE 1. Composition of the Essential Oil of *G. mite* var. *roseum ghahramaninejad*

Compound	RI	%	Compound	RI	%
Heptanal	903	0.4	α-Cedrene	1411	0.6
Benzaldehyde	960	Tr.	α-Humulene	1454	Tr.
3-Octanone	984	1.1	Geranyl acetone	1455	1.4
2-Pentyl furan	990	2.6	(*E*)-β-Ionone	1486	1.2
(2*E*,4*E*)-Heptadienal	1004	5.4	*n*-Pentadecane	1500	Tr.
(2*Z*,4*Z*)-Heptadienal	1017	4.0	Caryophyllene oxide	1580	2.0
1,8-Cineole	1029	1.5	*n*-Hexadecane	1600	0.4
Benzyl formate	1079	1.5	Humulene epoxide II	1608	Tr.
n-Nonanal	1100	7.5	Tetradecanal	1611	0.9
trans-Sabinol	1138	0.7	*n*-Heptadecane	1700	Tr.
Borneol	1169	18.0	Pentadecanal	1713	5.3
α-Terpineol	1191	1.2	*n*-Octadecane	1800	0.6
Methyl salicylate	1194	Tr.	6,10,14-Trimethyl-2-pentadecanone	1844	4.9
β-Cyclocitral	1217	0.5	(5*E*,9*E*)-Farnesyl acetone	1915	1.5
Pulegone	1237	Tr.	*n*-Eicosane	2000	0.4
cis-Piperitone epoxide	1253	3.3	Aldehydes		42.1
(2*E*)-Decenal	1264	1.3	Oxygenated monoterpenes		26.6
(2*E*,4*Z*)-Decadienal	1294	2.7	Ketones		8.6
(2*E*,4*E*)-Decadienal	1318	6.1	Oxygenated sesquiterpenes		3.5
(2*E*)-Undecanal	1363	7.0	Alkane		2.2
(*E*)-β-Damascenone	1382	1.4	Sesquiterpenes		1.8
n-Tetradecane	1400	0.8	Total identified		87.4
(*Z*)-Caryophyllene	1408	1.2			

Tr.: trace (< 0.05%). RI: retention indices relative to C_8–C_{28} *n*-alkanes on HP-5MS column. The components are listed in order of elution from the HP-5MS column.

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