ESSENTIAL OIL FROM *Galium verum* FLOWERS

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Galium verum L. (Rubiaceae Juss.) is widely distributed and is used commonly in folk medicine for treatments. It has been found that the herb contains essential oil, phenolcarboxylic acids, coumarins, flavonoids, tanning agents, and saponins. Flowers and leaves contain an enzyme that causes milk to curdle, owing to which they are used in cheese-making. Iridoids and terpenoids of essential oils from certain species have mainly been studied among the lipophilic compounds [1, 2].

We have previously investigated the fatty-acid composition of *G. verum* [3]. However, the components of the essential oil were not studied. Our goal was to study volatile compounds from flowers of *G. verum* collected during summer 2008 in Kharkov Oblast′. Analytical samples were obtained from freshly collected raw material by steam distillation and subsequent treatment of the distillate with hexane. The qualitative and quantitative compositions of the lipophilic fraction were established by GC with mass spectrometric detection.

TABLE 1. Component Composition of Essential Oil from *Galium verum* Flowers

Compound	RT, min	%*	%**	Compound	RT, min	%*	%**
3-Methyl-2-butanone	2.1	0.62	0.02	Benzylnitrile	12.75	0.57	0.02
Amylchloride	2.13	0.75	0.02	Camphor	12.95	0.61	0.02
Penten-3-ol	2.23	0.19	0.01	Borneol	13.68	0.38	0.01
Pentanone-2	2.28	0.38	0.01	*cis*-Epoxylinalool	13.8	0.45	0.01
Acetoin	2.46	0.86	0.02	*trans*-Epoxylinalool	13.96	0.45	0.01
2-Methylpentanol-2	2.67	1.50	0.04	α-Terpineol	14.52	1.31	0.04
Pyridine	2.84	0.52	0.01	4-Vinylphenol	15.47	0.59	0.02
3-Methylpentanol-3	2.87	0.84	0.02	Unidentified	15.81	0.61	0.02
3-Methyl-2-buten-1-ol	3.16	0.52	0.01	*o*-Aminoacetophenone	18.19	0.61	0.02
2,4-Pentadione	3.25	1.46	0.04	4-Vinyl-2-methoxyphenol	18.63	1.58	0.04
1-Methylcyclopentanol	3.38	1.56	0.04	Tetradecanoic acid	29.76	0.69	0.02
Unidentified	4.25	0.42	0.01	Unidentified	30.66	0.47	0.01
3-methylcyclopentanone	4.36	0.24	0.01	Pentadecanoic acid	31.07	0.45	0.01
cis-3-Hexen-1-ol	4.52	29.77	0.82	Dibutylphthalate	31.19	1.44	0.04
Hexanol	4.76	0.82	0.02	Hexadecenoic acid	32.02	0.77	0.02
Diethyleneglycol monomethyl ether	8.37	10.17	0.28	Hexadecanoic acid	32.24	2.79	0.08
				Unidentified	33.61	1.25	0.03
Benzyl alcohol	9.28	7.85	0.22	Eicosane	35.46	0.50	0.01
cis-Linalooloxide	10.55	0.65	0.02	Dioctylphthalate	37.57	1.71	0.05
trans-Linalooloxide	11.07	0.90	0.02	Squalene	39.96	20.82	0.57
Linalool	11.44	0.79	0.02	Unidentified	40.63	0.94	0.03

*Content in lipophilic fraction; **content in flowers.

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The studies were performed in a GC/MS (Agilent Technologies, USA) consisting of an Agilent GC 6890 gas chromatograph and Agilent 5973N mass-selective detector. Components were separated in an HP-5 quartz capillary column (19091J-433) (30 m × 0.25 mm) with phenylmethylsiloxane (5%) stationary phase. The column temperature was 60–240°C, run time 1 h from the start to the finish of the isothermal range of the temperature program. The temperature increase rate was 3°C/min. The sample volume was 0.3 μL with a flow division coefficient 1:15 and pressure at the column inlet of 40 kPa with He carrier gas. Mass was scanned in the range 38–300 amu. Compounds were identified by comparison with mass spectra in the Wiley 275 and NIST98 libraries and mass spectra of standards.

The observed compounds included nine terpenoids, five aromatics, and four fatty acids. The remaining compounds belonged to various classes of organic compounds. Five compounds were not identified. *cis*-3-Hexen-1-ol (29.77%), squalene (20.82), diethyleneglycol monomethyl ether (10.17), and benzyl alcohol (7.85) dominated the lipophilic fraction. The total amount of volatile compounds in *G. verum* flowers was 2.74% calculated per absolute dry raw material.

Table 1 lists the results.

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