

## GC-MS ANALYSIS OF CHEMICAL COMPOSITION OF *Sambucus ebulus* LEAVES

L. Chirigiu,<sup>1</sup> R. G. Chirigiu,<sup>2</sup> V. Tircomnicu,<sup>1</sup>  
and M. V. Bubulica<sup>1\*</sup>

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*Sambucus ebulus* L. is a common species of Eurasian origin that is mentioned as belonging to flora of different countries [1–3].

Carl von Linne is the first to give authenticity to the genus and its names and species while providing a detailed and complete description of them [4].

From *Sambucus ebulus* L. are harvested rhizomes, roots, leaves, flowers, and fruits. *Sambucus ebulus* L. is known in Romanian traditional medicine mainly for its bacteriostatic and diuretic action. It is harvested from June to August [5].

Plants were collected from the village of Imnicu de Sus, Dolj, Romania during July–August 2008.

After harvesting, the leaves were dried at temperatures between 20–25°C in a dark room. After drying, the leaves were ground and extracted with ethyl alcohol and ethyl ether.

The mass of the extraction cartridge was 10 to 15 g of spray product. Extraction with diethyl ether lasted 8 hours in a Soxhlet extractor. After cooling, the system was washed with ether, and the combined extracts were concentrated by distillation in a rotavapor to 50 mL volume and analyzed by GC-MS. The cartridge with residues was dried and weighed.

Examined material: *Sambucus ebulus* L. leaves; substances: solvents (ethyl alcohol, ethyl ether); equipment: Hewlett Packard 6890 gas chromatograph with 5973 mass spectrometer detector, column: BD1 30 m × 0.25 mm × 1 μm, T<sub>inj.</sub>: 290°C, carrier gas flow rate (He) = 0.8 mL/min, split ratio 188:1, = 188:1, temperature source MS = 230°C, quadrupole MS = 150°C, interface MS = 300°C, Soxhlet extractor, LABOROTA rotavapor 4000.

Results of extraction: 2.156% extractable compounds in ether and 11.43% extractable compounds in alcohol.

Test results are presented in Tables 1 and 2.

A large number of compounds were identified in *Sambucus ebulus* L. for the first time in the the specialty literature using a simple and inexpensive method with reduced solvent consumption. The main constituents with therapeutic properties of this plant are phenolic compounds, found in great numbers in the leaves of *Sambucus*, which are associated with organoleptic, nutritional, and antioxidant properties. Four of them (4-ethylcatechol, 2-methoxy-6-(2-propyl)-phenol, 4-ethyl-1,3-benzenediol, 1,2-benzenediol, 2-methoxy-4-vinylphenol) are common in medicinal plants (*Maticaria chamomilla*, *Melilotus officinalis*, *L. album*) and are responsible for the antiinflammatory effect of this plant [6]. The presence of a large number of hydrocarbons and ethers in plants can be correlated with their analgesic properties. Also, it is known that ethers in the composition of identified plants in traditional medicine are responsible for their antibacterial (yarrow, calendula) or calming (chamomile) properties [7]. Also, a multitude of hydrocarbons in plants can be linked with their geographical affiliation and the soil characteristics of the place where they are harvested.

There have also been identified a great number of fatty acids (palmitic, linoleic, stearic, myristic, isovaleric, 3-methylvaleric acids). Isovaleric and valeric acids are the major source of the unpleasant odor of the leaves and both are used as calming agents.

Other components with pharmacological importance are quinic acid (an antiviral agent and a component of Tamiflu vaccine) and benzyl alcohol, used as a bacteriostatic agent.

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1) University of Medicine and Pharmacy, Faculty of Pharmacy, Craiova, Romania, Petru Rares Street, Romania, Postal Code 200638, fax: 0040 251 533713, e-mail: liviu\_chirigiu@yahoo.com; mariaviorica.bubulica@gmail.com; 2) Elena Cuza College, Craiova, Mihai Viteazul Street, No. 12, Romania, fax: 0251 416353. Published in Khimiya Prirodnykh Soedinenii, No. 1, pp. 111–112, January–February, 2011. Original article submitted September 24, 2009.

TABLE 1. Compounds Contained in the Ethereal Extract of the Leaves of *Sambucus ebulus*

Compound	Retention time	%	Compound	Retention time	%
Ethyl acetate	3.77	81	<i>n</i> -Hexadecanoic acid (palmitic acid)	26.52	98
2-Ethoxybutane	5.03	91	9Z,12Z-Octadecadienoic acid (linoleic acid)	28.23	99
3-Methylbutanoic acid	10.00	91	9Z,12Z,15Z-Octadecatrien-1-ol	28.29	98
1,1'-Cyclopropylidene- <i>bis</i> -benzene	24.27	94	Octadecanoic acid (stearic acid)	28.50	90
Tetradecanoic acid (myristic acid)	24.39	98			

TABLE 2. Compounds Contained in the Alcohol Extract of the Leaves of *Sambucus ebulus*

Compound	Retention time	%	Compound	Retention time	%
Acid acetic	3.33	86	2-Methoxy-4-vinylphenol	18.78	90
Ethyl acetate	3.80	72	2-Methoxy-6-(2-propyl)-phenol	19.39	90
Diethoxymethane	5.59	91	4-Ethylcatechol	19.57	73
1,1-Diethoxyethane	7.29	83	4-Ethyl-1,3-benzenediol	19.57	82
Furfural	9.51	95	D(+)-Aloze	20.60	90
3-Methylbutanoic acid (isovaleric acid)	10.11	91	1,6-Anhydro- $\beta$ -D-glucofuranose	20.62	78
3-Methylpentanoic acid (3-methylvaleric acid)	12.26	90	(levoglucosan)		
5-Methyl-2-furan carbaldehyde	12.55	95	D(-)-Quinic acid	22.04	86
Benzilic alcohol	14.09	90	4-Chlorophenyl-isothiocyanate	23.13	75
Hydrazide of 2-furancarboxylic acid	14.67	72	Methylic ester of 4-hydroxy-3-methoxy benzene acetic acid	23.89	89
2,3-Dihydro-3,5-dihydroxy-6-methyl-4H-pyran-4-one	16.04	91	<i>n</i> -Hexadecanoic acid (palmitic acid)	26.52	98
Benzoic acid	16.18	93	9Z,12Z-Octadecadienoic acid	28.22	99
1,2-Benzenediol	16.75	92	9-Octadecenoic acid	28.29	98
5-Hydroxymethyl-2-furan carbaldehyde	16.94	91	Octadecanoic acid (stearic acid)	28.50	98
Hydroquinone	17.71	91	9Z,12Z-Octadecadienoic acid	29.04	93

In the alcoholic extract of *Sambucus ebulus* L., the area of the identified components was 90.65% of the total area, and in the ethereal extract the area was 91.87% of the total area. The compounds identified in both the ether and alcohol extracts represent 87% of the total components.

## REFERENCES

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