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ESSENTIAL OIL OF *Peucedanum oreoselinum* FRUITS COLLECTED NEAR VILNIUS

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Fruits of Peucedanum oreoselinum *(L.) Moench. were collected at three sites in 1995-1998 and contained 1.5-5.0% essential oil. Analyses were performed using GLC and GC-MS. The main component of the essential oil is limonene (44.1-82.4%). The majority of examined samples contained more limonene than has been reported in the literature. Only in sunny locations do plants synthesize significant quantities of γ-terpinene (12.2-17.5%) and β-pinene (8.5-14.5%). Small quantities of α-pinene are present in all studied samples of essential oil (4.0-8.3%). Monoterpenes comprise 97.1-98.6% of the essential oil. The remainder consists of sesquiterpenes.*

Various species of the plant genus *Peucedanum* L. have recently attracted much attention. Not only the chemical compositions of the plants [1, 2] but also their biological activities [3-5] have been studied. The composition of the essential oils of several species of *Peucedanum* L. [including *Peucedanum oreoselinum* (L.) Moench] has been reviewed [6]. The essential oils of *P. oreoselinum* contain β-pinene, sabinene, limonene (37-49%), α-terpinene, β-terpinene, and *p*-cymene. These same monoterpenes were found in the essential oil of the fruits of plants from southern Europe [7]. However, they contained only 26% limonene. The essential oil of *P. palustre* Moench has a composition similar to those mentioned above [6, 8]. Essential oils from other parts of the plants, including the roots, differ substantially from those of the fruits [6-9]. Terpenes of higher molecular weight are synthesized to a greater extent in the roots [8, 9].

Essential oils containing large amounts of limonene and limonene itself are interesting for several reasons. They are used to study cancer [10, 11]. The compound *D*-limonene exhibited activity against chemical agents that cause cancer [11]. The essential oils mentioned above and limonene possess spasmolytic activity [12] and inhibit acetylcholinesterase [13]. Limonene and essential oils containing significant quantities of it stabilize polysaturated fatty acids [14, 15]. Limonene is recommended as a stabilizer of the fragrances citral and cinnamic aldehyde [15]. β-Cariophyllene and α- and β-pinenes, which are components of the studied plants (Table 1), also act as preservatives [14]. It has been noted that limonene increases the combustibility of juniper [16]. Limonene is used in numerous syntheses, for example, the synthesis of biologically active compounds (rotundial), a mosquito repellant [17].

Essential oils of *P. oreoselinum* collected at various sites near Vilnius in 1995-1998 account for 1.5-5.0% by weight of the air-dried fruits. Chromatography on polar and nonpolar capillary columns and mass spectra demonstrated that the content of monoterpenes is 97.1-98.6% of the essential oils (Table 1). The main component is limonene (44.1-82.4%). The amount of limonene in six of seven studied samples was greater (51.0-82.4%) than that in samples reported in the literature (26-49%) [6, 7].

Sunlight increases the amount of γ-terpinene (12.2-17.5%) and β-pinene (8.5-14.5%) in the essential oils (Table 1, Antavilyai, Sapegine I). Plants growing in a shady location (Sapegine II) contain only 0.6-0.9% γ-terpinene and 1.0-1.5% β-pinene. The amount of γ-terpinene in the studied samples was slightly lower (0.6-17.5%) than in the essential oil of *P. oreoselinum* fruits from southern Europe (25%) [7]. The greater content of γ-terpinene may be due to the larger number of sunny days. α-Pinene was found in all studied samples in approximately equal quantities (4.0-8.3%). However, its content in essential oils from plants collected in warmer regions was slightly higher (11%) [7]. Sabinene is present in all studied *P. oreoselinum* plants growing in various countries [6, 7]. The habitat determines the quantities of minor monoterpene hydrocarbons (*p*-cymene, α- and β-terpinenes, myrcene, α- and β-phellandrenes, E-ocymene, and α-terpinolene) and monoterpene alcohols (4-terpinenol and α-terpineol) that are synthesized (Table 1) [6, 7].

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TABLE 1. Composition of Essential Oils of *Peucedanum oreoselinum* (L.) Moench. Growing in the Wild Near Vilnius

Component	Component content (%) from collection site						
	Antavilyai		Sapegine I			Sapegine II	
	1995	1996	1995	1996	1997	1997	1998
α-Pinene	6.8	5.9	6.2	5.1	8.3	4.0	6.3
β-Pinene	10.5	8.5	12.3	12.9	14.5	1.0	1.5
Sabinene	3.5	3.2	2.1	2.1	2.0	4.6	8.0
Myrcene	tr	tr	1.1	1.2	0.4	2.1	1.7
α-Phellandrene	4.7	5.8	4.5	3.5	6.1	tr	0.8
Limonene	55.0	56.6	51.0	55.1	44.1	82.4	76.0
β-Phellandrene	tr	0.9	2.5	2.0	3.8	1.1	1.0
γ-Terpinene	15.0	12.2	13.8	13.0	17.5	0.6	0.9
E-Ocymene	0.5	1.7	0.9	1.1	1.1	0.6	0.8
α-Terpinolene	0.5	0.7	0.5	0.2	0.4	0.4	0.2
4-Terpinenol	0.6	1.1	3.1	1.7	0.3	0.2	0.1
α-Terpineol	0.1	0.5	0.1	0.1	0.1	0.2	0.1
Total	97.2	97.1	98.1	98.0	98.6	97.2	97.4

Trace amounts of sesquiterpenes are found in the essential oil of fruits from southern Europe [7]. The samples studied by us contain ~2% of these compounds. The identified compounds are β-cariophyllene (0.16-0.79%), β-cubebene (0.16-0.31%), cingiberene (0.24-0.58%), β-bisabolene (0.05-0.10%), β-sesquiphellandrene (0.10-0.28%), δ-cadinene (0.00-0.54%), and cariophyllene oxide (0.29-0.54%).

Thus, the essential oil of *P. oreoselinum* (L.) Moench. fruits collected near Vilnius contain significant amounts of limonene and can be used for the purposes outlined above [10-17]. We note that the essential oil of fruits collected in shady locations contain 76.0-82.4% limonene.

EXPERIMENTAL

Fruits (0.3-0.5 kg) were collected in the middle of August near Vilnius (Lithuania) in 1995-1998. The essential oil of the fruits was obtained by steam-distillation of the air-dried material (100 g) at a 1:5 ratio.

The components of the essential oil were identified using an HP 5890 gas chromatograph coupled with an HP 5971 mass-selective detector (Hewlett—Packard, USA). Data for the mass spectra and retention times were obtained [18, 19]. Electron-impact ionization by 70-eV electons was used. Chromatographic separation used CP Sil 8 CB (50 m x 0.32 mm) and HP-20 M (25 m x 0.25 mm) capillary quartz columns with a temperature program. The column was held for 2 min at 60°C. Then, the temperature was raised to 250°C at 6°C/min with a final isothermal setting for 5 min at 250°C. The vaporizer temperature was 280°C; detector, 250°C; carrier-gas flow rate (He), 1.3 and 2 ml/min.

Quantitative analysis of the essential oil used a flame-ionization detector under chromatography conditions identical to those of the GC-MS.

REFERENCES

1. W. E. Campbell, S. Mathee, and F. Wewers, *Planta Med.*, **60**, 586 (1994).
2. K. Qutiner, P. Vuorela, R. Hinkkanen, R. Hiltunen, and H. Vuorela, *Planta Med.*, **61**, 259 (1995).
3. M. Miyazawa, H. Shimamura, R. C. Bhuva, S. Nakamura, and H. Kameoka, *J. Agric. Food Chem.*, **44**, 3444 (1996).
4. A. Hiermann and D. Schantl, *Planta Med.*, **64**, 400 (1998).
5. G. Hsiao, N. Ko Teng, T. T. Jong, and C. M. Teng, *Biol. Pharm. Bull.*, **21**, 688 (1998).

6. *Plant Resources of the USSR. Flowering Plants, Their Chemical Composition and Use* [in Russian], Nauka, Leningrad (1988), p. 147.
7. A. A. Sevarda, G. A. Kuznetsova, S. Pavlovic, and R. Jancic, *Arh. Farm.*, **32**, No. 3-4, 121 (1982).
8. S. A. Kozhin and E. I. Sorochinskaya, *Rast. Resur.*, **4**, No. 1, 77 (1968).
9. S. A. Kozhin and G. G. Senchenko, *Rast. Resur.*, **4**, No. 2, 183 (1968).
10. P. L. Crowell, C. E. Elson, H. H. Baiey, A. Elegbede, J. D. Haag, and N. N. Gould, *Cancer Chemother. Pharmacol.*, **35**, No. 1, 21 (1994).
11. S. G. Yu, P. J. Anderson, and C. E. Elson, *J. Agric. Food Chem.*, No. 43, 2144 (1995).
12. G. Mazzanti, M. Lu, and G. Salvatone, *Phytother. Res.*, **12**, 592 (1998).
13. M. Miyazawa, H. Watanabe, and H. Kameoka, *J. Agric. Food Chem.*, **45**, 677 (1997).
14. Z. Recsan, G. Pagliuca, M. Piretti, L. Penzes, A. Youdim-Kuresh, R. Noble, and S. Deans, *J. Essent. Oil Res.*, **9**, 53 (1997).
15. R. J. Steltenkamp, M. L. Douglass, and G. E. Natarelli, U.S. Pat. No. 4562064.
16. M. K. Owens, C.-D. Lin, C. A. Taylor, and S. G. Whisenant, *J. Chem. Ecol.*, **24**, 211519 (1998).
17. H. Takikawa, Y. Yamazaki, and K. Mori, *Eur. J. Org. Chem.*, No. 2, 229 (1998).
18. I. G. Zenkevich, *Rast. Resur.*, **32**, 48 (1996).
19. I. G. Zenkevich, *Rast. Resur.*, **33**, 16 (1997).