ESSENTIAL OILS OF WORMWOODS OF THE Absinthium DC SECTION

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Continuing an investigation of the chemical compositions of the essential oils of wormwoods (Artemisia macrocephala Jacq. [1], A. sieversiana Willd [2], A. jacutica Drob. [3], A. samoiedorum, Pamp., and A. absinthium L.) by the GLC method, we have determined the component compositions of the mono- and sesquiterpene fractions. The raw material for analysis was gathered in the flowering phase in the environs of Tomsk (A. absinthium, A. sieversiana), the environs of the village of Kosh-Agach, Gorno-Altai Autonomous Region (A. macrocephala), and the environs of Yakutsk (A. jacutica) and of Igarka, Krasnoyarsk Territory (A. samoiedorum).

Chromatographic analysis was performed on a Chrom-5 instrument. Capillary column 25 m long, polymethylsiloxane, column temperature 60-250°C, rate of programming 6°C/min; temperature of the evaporator 240°C and of the detector 170°C; chart speed 6 mm/min; rate of feed

TABLE 1. Quantitative Compositions of the Essential Oils of Wormwoods Artemisia of the Absinthium DC Section

Component	A. sieversiana	A. jacutica	A. macrocephala	A. samoiedorum	A. absinthium
1. α-Pinene	0,5	0,1	—	—	Tr.
2. Camphene	19,1	—	—	—	—
3. Sabinene	1,6	1,8	—	—	17.3
4. Myrcene	—	18,6	—	—	21,5
5. β-Pinene	12,7	—	0,7	—	—
6. p-Cymene	—	Tr.	—	—	0,2
7. Δ^3-Carene	—	Tr.	—	—	—
8. Limonene	0,9	18.5	1,1	—	0,1
9. α-Terpinene	—	Tr.	—	—	—
10. Terpinolene	Tr.	Tr.	Tr.	Tr.	Tr.
11. α-Terpineol	—	0,7	—	—	—
12. Thujone	—	—	—	—	7,4
13. Thyjyl acetate	—	—	—	—	18,9
14. Thujyl alcohol	—	—	—	—	10,1
15. Camphor	1,9	Tr.	0,3	—	5,5
16. Borneol	0,3	—	—	—	0,1
17. Terpineol-4	0 5	—	—	—	—
18. Thymol methyl ether	0,7	—	—	—	—
19. Bornyl acetate	Tr.	—	2,1	—	4,4
20. Copaene	4,3	—	0,5	—	—
21. Caryophyllene	3,0	—	2,0	2,8	2,2
22. β-Farnesene	1,7	1,2	—	—	—
23. Elemene	—	0,1	—	—	—
24. γ-Muurolene	2,2	0,1	—	5 2	3,3
25. Germacrene-D	—	0,4	—	—	0,7
26. α-Humulene	—	0,1	—	—	—
27. α-Murrolene	6,2	—	1,8	1,4	0,8
28. γ-Cadinene	—	4,8	—	0,9	—
29. δ-Cadinene	1,6	2.4	1,6	0,6	—
30. Bisabolol	—	5,0	—	—	—
31. Caryophyllene oxide	—	—	0,8	1,2	—
32. Ledol	0,7	—	2,7	—	—
33. Caratol	—	—	—	3,2	—
34. δ-Cadinol	0,5	0,8	1,3	2,1	—
35. Selinane alcohol	—	11,8	—	—	—
36. Intermedeol	0,6	0,8	0,7	1,3	—
37. Chamazulene	0,4	20,0	38,4	2 2	Tr.
38. Ajanol	0.6	—	0,2	0,3	—
Unidentified	40,0	2,9	45,8	78,8	7,5

Tr.) Amount of component in the fraction not more than 0.1%.

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of carrier gas, nitrogen, 1.3 ml/min. The components were identified from their relative retention times and with the aid of the method of additives. The quantitative compositions of the components were determined by the method of simple normalization (Table 1).

It must be mentioned that the species studied are of practical interest as sources of azulenes but are difficult to distinguish morphologically. The quantitative compositions of the essential oils show their species individuality.

Table 1 gives original results on the compositions of the essential oils of wormwoods of the section investigated. This is the first time that information has been given on the quantitative compositions of the essential oils of A. absinthium (Siberian specimen) and A. samoiedorum.

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A NEW SESQUITERPENE LACTONE – OPOFERDIN FROM Ferula oopoda

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The resin of the roots of Ferula oopoda (Boiss. et Buhse) Boiss. contains, in addition to the main lactones (badkhysin, badkhysinin, oopodin, and dehydroopodin), several minor ones. One of them has been isolated by the repeated rechromatography of fractions 16-25 obtained from the basic column by elution with petroleum–benzene (3:2). This lactone ($C_{20}H_{24}O_5$, mp 126-127°C) is new, and we have called it opoferdin.

The IR spectrum of opoferdin contained the absorption bands of the CO group of a γ-lactone ring (1760 cm^{-1}), of the CO of an α,β-unsaturated ester group (1705 cm^{-1}), and of double bonds (1670, 1640 cm^{-1}).

In the PMR spectrum of the lactone under investigation, the region of CH_3 groups contained the signals of $CH_3-\overset{|}{\underset{|}{C}}-$ (s, 1.25 ppm), $CH_3-\overset{|}{C}=$ (t, 1.82 ppm, J = 1.5 Hz), and $CH_3-CH=$ (d, 1.95 ppm, J = 7 Hz, each component being additionally split by 1.5 Hz).

Doublets at 5.53 ppm (J = 3 Hz, 1H) and 6.30 ppm (J = 3 Hz, 1H) showed the presence of an exomethylene group in the molecule at C-11. A multiplet signal at 6.08 ppm (–CH=, 1H), together with the signals of vinylmethyl groups (at 1.82 and 1.95 ppm) characterized the ester group as angeloyl.

A one-proton doublet at 4.90 ppm (J = 6.0 Hz) belonged to a gem-ester proton (H-1). Signals at 5.46 ppm (d, J = 10 Hz, 1H) and 6.14 ppm (q, J_1 = 10; J_2 = 6 Hz, 1H) related to olefinic protons at C-3 and C-2, respectively.

In the opoferdin molecule the lactone ring is located at C(6)–C(7), as was shown by one-proton signals at 4.68 ppm (q, J_1 = 10, J_2 = 7.5 Hz) and 2.22 ppm (d, J = 10 Hz, H-5).

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