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CHEMICAL COMPOSITION OF THE ESSENTIAL OIL OF *Artemisia glabella*

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The results are given of the gas-chromatographic analysis in a nonpolar capillary column, after preliminary separation by means of adsorption chromatography on alumina, of samples of the essential oils of three populations of the endemic species Artemisia glabella *Kar. et Kir. (Asteraceae) of Kazakhstan. The complex component composition of the samples of essential oils was practically independent of the conditions of the growth site. The results obtained witness a chemosystematic difference between* A. glabella *and* A. obtusiloba.

There are contradictory statements with respect to the systematics of the two wormwood species *Artemisia obtusiloba* Ledeb. and *Artemisia glabella* Kar. et Kir. The first species was described by K. F. Lebedur for the flora of the Altai, and the second by G. S. Karelin and I. P. Kirillov from collections made on the territory of Kazakhstan [1]. In the USSR flora, P. P. Polyakov [2] combined them into one species, giving priority to the name *Artemisia obtusiloba*. In his turn, N. V. Pavlov [3] separated out *A. glabella* into a distinct endemic species of Kazakhstan with a small area of distribution, which P. N. Krylov [4] extended somewhat to the east, determining its boundary by regions of the Kazakh fine-sand area to Tarbagataya. The area of distribution of *A. obtusiloba* is bounded by the south of Western Siberia, the Altai mountains, and North-Western Mongolia [4].

The morphological characteristics of *A. glabella* and *A. obtusiloba* were analyzed by N. S. Filatova and somewhat expanded by A. N. Kupriyanov et al. [6], and this indicated the existence of two independent species.

A chemical study of these species of wormwood for their lactone content showed the presence of the sesquiterpene lactones arglabin, argolide, and ketopelenolide B in *A. glabella* [7], and of coumarins in *A. obtusiloba* [8].

Continuing the study of the chemical composition of *A. glabella*, we have investigated the essential oil of this wormwood species.

The component composition of the essential oil of *A. glabella*, determined with the aid of capillary GLC on a nonpolar methylsilicone stationary phase and a flame-ionization detector, included more than 70 compounds (Table 1). The quantitative levels of the latter in the essential oil showed the characteristic chemical composition of *A. glabella*, the most abundant components being 1,8-cineole (12%), linalool (8%), terpineol-4 (6.5%), α-terpineol (5%), and sabinol derivatives (5%) — substances characteristic for the essential oils of plants of other genera. At the same time, the essential oil contained series of genetically linked compounds: *p*-cymene, cuminaldehyde, cumic alcohol and its acetate; α-thujene, sabinene, sabinene hydrate, sabinol and its esters with a homologous series of fatty acids; and α-pinene, myrtenal, verbenone, myrtenol, verbenol, 2,3-dehydro-1,8-cineole, 1,8-cineole, *p*-menth-2-ol, etc.

C. Bicchi's results on the component composition of the essential oil of *A. glabella* given previously [9] differ from those that we have obtained on the composition of the volatile compounds, apart from the fact that we used a different method of investigation. At the same time, it must be mentioned that the main components of the essential oil of this plant grown in Italy are the same, which shows a stable chemical composition of the essential oil even with a change in soil and climatic conditions. It must also be mentioned that the essential oil of *A. glabella* contains azulene-forming sesquiterpenes (about 1%), which are absent from the essential oil of *A. obtusiloba* [10, 11].

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TABLE 1. Component Composition of the Essential Oil of *A. glabella*

Peak No.	Component	Content, wt.-%		
		Tagyly mountains	environs of Karkaralinsk	valley of R. Taldy
1.	α-Thujene Sabinyl	Tr.	0.3	0.2
2.	α-Pinene	2.6	6.2	3.1
3.	α-Fenchene	0.5	0.3	0.6
4.	Camphene	Tr.	Tr.	Tr.
5.	Sabinene	0.5	0.7	0.8
6.	β-Pinene	0.3	0.6	0.5
7.	2,3-Dehydro-1,8-cineole	Tr.	Tr.	Tr.
8.	α-Phellandrene	0.2	Tr.	Tr.
9.	β-Terpinene	0.5	1.1	0.7
10.	*p*-Cymene	0.3	0.7	0.6
11.	Limonene	1.8	2.8	2.0
12.	1,8-Cineole	10.3	12.9	12.4
13.	γ-Terpinene+artemisia ketone	0.7	0.2	0.7
14.	Artemisia alcohol	0.2	0.2	0.2
15.	*cis-p*-Menth-2-enol	Tr.	Tr.	Tr.
16.	Sabinene hydrate	Tr.	0.5	Tr.
17.	Linalool	4.2	8.2	5.2
18.	*trans-p*-Menth-1-enol	0.2	0.5	0.2
19.	Camphor	0.7	1.0	0.3
22.	Pinocarvone	0.6	0.3	0.6
25.	Verbenone	1.3	0.5	0.4
26.	Terpineol-4	2.5	4.5	5.4
27.	*trans*-Verbenol	5.6	3.2	6.0
28.	Borneol	0.8	2.8	1.9
30.	α-Terpineol	0.2	5.2	6.0
32.	Myrtenol	1.2	1.1	1.2
33.	Phellandral + p-iso-propyl - phenol	Tr.	Tr.	Tr.
34.	Cuminaldehyde	2.0	2.0	1.2
35.	Myrtenal	0.3	0.5	1.1
36.	*p*-Menth-1-en-9-ol	0.3	0.6	1.1
39.	*p*-Menth-2-en-7-ol	3.8	1.2	1.4
40.	Ylangene	1.9	0.5	1.4
41.	Fenchyl acetate	1.1	0.5	0.8
42.	Cuminyl alcohol	1.3	1.4	1.2
43.	Bornyl acetate	4.1	2.6	2.1
44.	*trans*-Sabinol	Tr.	Tr.	Tr.
45.	Cuminyl acetate	1.0	0.5	0.2
46.	Carvacrol	Tr.	Tr.	Tr.
47.	Linalyl propionate	0.6	Tr.	Tr.
48.	α-Elemene	Tr.	Tr.	Tr.
49.	Sabinyl acetate	2.0	1.9	1.3
50.	Methyleugenol	1.3	0.6	1.2
51.	Aristolene	1.1	1.0	1.2
52.	β-Elemene	0.3	0.3	0.2
53.	α-Caryophyllene (Z)	1.2	0.5	1.0
54.	β-Caryophyllene (E)	0.6	0.4	1.0
55.	Nerol	1.6	1.3	1.3
56.	α-Bisabolene	1.0	0.8	0.5
57.	α-Cadinene	0.8	0.8	0.6

TABLE 1. (Continued)

Peak No.	Component	Content, wt.-%		
		Tagyly mountains	environs of Karkaralinsk	valley of R. Taldy
58.	β-Cadinene	0.9	0.6	0.9
59.	Eugenol	0.7	0.6	0.8
60.	Neryl butyrate	1.1	0.5	1.4
61.	Caryophyllene oxide	1.2	1.1	1.1
62.	*trans*-Nerolidol	2.1	1.0	1.5
63.	Sabinyl propionat	1.5	6.0	2.5
64.	Chrysanthemic acid	1.1	1.0	1.2
65.	Spathulenol	1.1	2.4	0.9
66.	Farnesol	1.3	1.4	1.5
67.	Chamazulene	0.5	0.3	0.9
68.	Farnesyl acetate	0.7	0.6	0.4
69.	Sabinyl isovalerate	1.7	0.8	1.8
70.	Sabinyl valerate	1.4	1.3	2.3
71.	Methyl octadecanoate	0.7	Tr.	Tr.

It can be seen from Table 1 that the component compositions of the essential oils of *A. glabella* from different growth sites of Central Kazakhatan are similar and the quantitative amounts of the main components differ little. This circumstance permits the hope of constancy of the quality of the industrial essential oil from wild-growing raw material and also of constancy of the chemical composition of plants introduced into cultivation.

EXPERIMENTAL

The essential oil of *A. glabella* was obtained by the steam distillation of the epigeal parts, dried to the air-dry state and ground, of plants gathered in the flowering stage from populations growing in various sites of Central Kazakhstan at a considerable distance from one another and differing by their growth conditions. Constants of the essential oil of *A. glabella:* d^{20} 0.93; n_D^{20} 1.4806; acid No. 5.3; ester No. 28.3. Yield 0.91—1.20%. It formed a clear mobile bluish green liquid possessing a pleasant musky smell.

The component composition of the essential oil was determined by gas chromatography on a Chrom 5 instrument fitted with a computer, using a 50-m column with a diameter of 32 mm filled with a nonpolar methylsilicone phase. Flame-ionization detector. Injector temperature 220°C; Ar at 2 ml/min, flow split 1:20; programming in the interval of 60—250°C at 3 deg/min.

The components of the composition were identified by comparing the retention times of the peaks on the chromatograms with the retention times of known authentic compounds and also by the use of literature values for Kovàts indices [12] To increase reliability, the essential oil was saponified and separated by adsorption chromatography on columns of alumina into hydrocarbon and oxygen-containing fractions. The quantitative composition was determined by the normalization method in the computer treatment of the results.

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