0.5; and limonene; 0.5. Oxygen-containing compound made up 95.2%, including methylchavicol, 81.5; cis-anethole, 1.1; trans-anethole, 9.8; anisaldehyde, 1.5; anisic acid, 0.6; eugenol, 0.4; thymol, 0.3; chamazulene, 0.5; and unidentified components, 1.5% (Fig. 1).

Fewer components (13) were detected in the EO from the fruit Monoterpene hydrocarbons made up 1.8%, including α-pinene, 1.0; camphene, 0.2; α-terpene, 0.3; and limonene, 0.3. Oxygen-containing compounds made up 97.8% including: methylchavicol, 82.6; cis-anethole, 2.3; trans-anethole, 10.0; anisaldehyde, 1.2; anisic acid, 0.8; eugenol, 0.5; and thymol 0.4; the total amount of unidentified components being 0.4% (Fig. 2).

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# ESSENTIAL OIL OF Achillea cuneatiloba


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In the Azerbaidzhan SSR, the yarrow Achillea cuneatiloba Boiss. et Buhse grows in the Nakhichevan ASSR and on the Apsheron Peninsula. There is information in the literature on the chemical composition of A. filipendulina Lam., A. millefolium L., A. nobilis L., and A. biebersteinii Afan. [1-3], but none of the chemical composition of the essential oil (EO) of A. cuneatiloba which grows in the USSR.

We give the results of an investigation of the chemical composition of the EO isolated by steam distillation [4] from the epigeal parts and inflorescences of A. cuneatiloba collected in the environs of the villages of Novkharny, Bil'gya, Zagul'ba, and Buzovny in the Apsheron region. The EO consisted of an aromatic blue-green liquid slightly burning to the taste.

We have studied the dynamics of the EO content in A. cuneatiloba. The maximum amount of EO was found in the mass-flowering phase (1.0%).

The chemical composition of the EO was determined by gas-liquid chromatography on a Janaco chromatograph under the following conditions: copper column 3 mm 0.75 m; stationary phase PEG 2000 (5%); column temperature programmed at 6°C per minute from 70 to 190°C; temperature of the flame-ionization detector 210°C and of the evaporator 210°C. Identification was carried out by the method of adding pure substances and from relative retention times in accordance with literature information. The amounts of the components were calculated from the areas of the peaks by the internal-normalization method [6].


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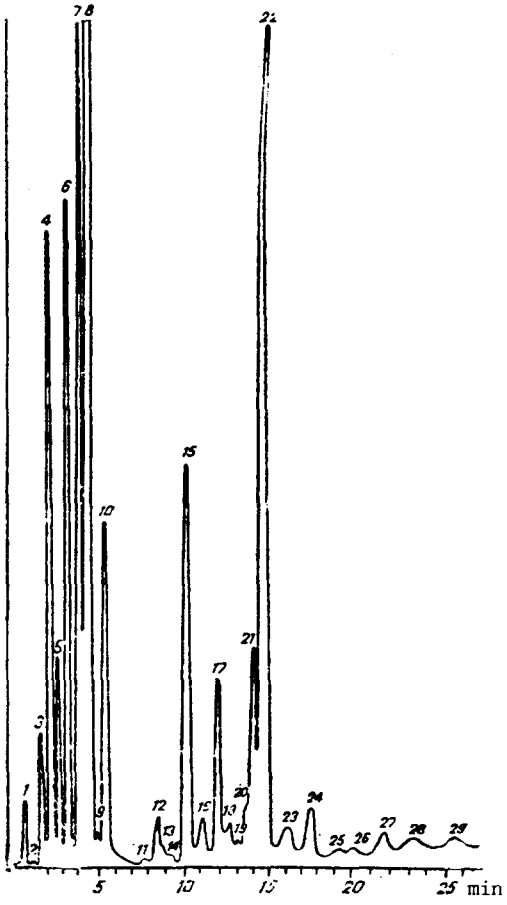


Fig. 1

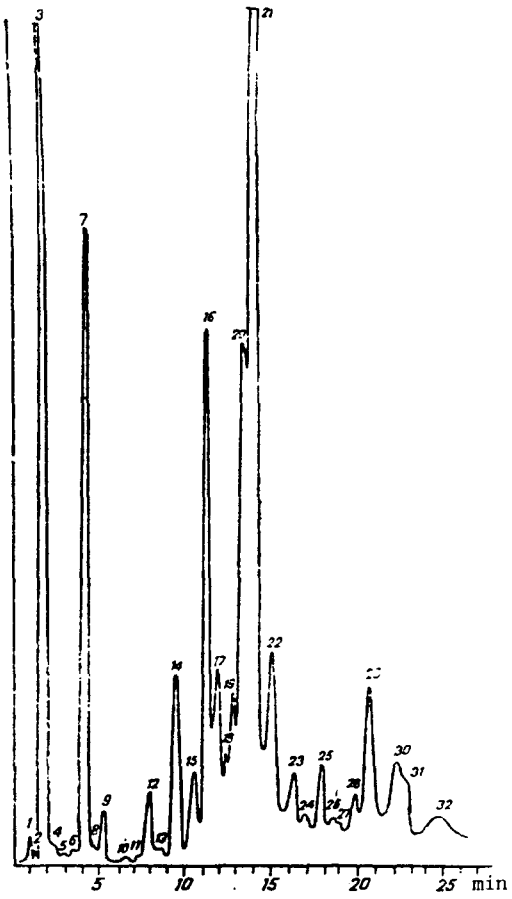


Fig. 2

Fig. 1. GLC of the essential oil from the epigeal parts of Achillea cuneatiloba: α-thujene; 2) α-pinene; 3) camphene; 4) β-pinene; 5) β-phellandrene; 6) limonene; 7) 1,8-cineole; 12) p-cymene; 13) citronellal; 14) linalool; 15) camphor; 16) borneol; 17) l-menthone: 18) menthol; 22) chamazulene; 23) pulegone; 24) α-terpineol; 25) geraniol; 26) phenylethyl alcohol; 27) eugenol; 28) isoeugenol; 29) thymol; 8-11 and 19-21) unidentified components.

Fig. 2. GLC of the essential oil from inflorescneces of Achillea cuneatiloba: 1) α-thujene; 2) α-pinene; 3) camphene; 4) β-pinene; 5) β-phellandrene; 6) limonene; 7) 1,8-dineole; 12) p-cymene; 14) citronellal; 15) linalool; 16) camphor; 17) borneol; 18) l-menthone; 19) menthol; 21) chamazulene; 22) pulegone; 23) α-terpineol; 24) geraniol; 25) phenylethyl alcohol; 28) eugenol; 29) isoeugenol; 30) thymol; 8-11, 13, 20, 26, 31, and 32) unidentified components.

In the EO from the epigeal parts of A. cuneatiloba we detected 29 components (Fig. 1). Monoterpene hydrocarbons made up 18.3% in which β-pinene (5.7%) and limonene (8.9%) predominated. Oxygen-containing components made up 41.0%, and in these the proportion of 1,8-cineol was 11.2%, of camphor 7.3%, and of l-menthone and others 3.4%. Aromatic hydrocarbons made up 23.5%, of whcih 22.4% consisted of chamazulene.

In the EO from the inflorescences of A. cuneatiloba we detected 32 components (Fig. 2). Here the monoterpene hydrocarbons made up 9.6%, which was only half the amount in the EO from the epigeal parts, while, in contrast to the EO from the epigeal parts, the predominating component was camphene (9.0%). Oxygen-containing compounds made up 44.5%. Here, 1,8-cineole, camphor, and pulegone predomianted (9.0, 7.6, and 4.4%, respectively). The amounts of these components differed little from those in the EO from the epigeal parts of the plant. Aromatic hydrocarbons amounted to 27.4%, of which 26.0% was chamazulene.

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# A STUDY OF THE CHEMICAL COMPOSITION OF COMMERCIAL ROOTS OF *Panax ginseng*

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The chemical composition of various parts of ginseng (roots, leaves, flowers, fruit) has been studied fairly widely [1-4]. It is known that the biological activity of ginseng is due to glycosides – ginsenosides [1]. A knowledge of the composition of the ginsenosides is important for a correlation of the biological effect on various medicinal forms from ginseng and also for a comparative chemotaxonomic study of species of the genus *Panax*.

According to the literature, 29 ginsenosides have so far been isolated from the roots of *Panax ginseng* C. A. Mey, ("white" and "red" roots) [1-4].

The aim of the present work was to investigate the chemical composition of previously unstudied commercial roots of ginseng grown from seeds of *Panax ginseng* C.A. Mey. in the plantations of the Zhen'shen' Sovkhoz [communal farm] (Maritime Territory, Anuchino region).

The air-dry six-year roots (1.96 kg) were treated with 70% aqueous methanol for the complete extraction of the ginsenosides. After elimination of the solvent, the residue was dissolved in the minimum amount of water and was extracted successively with diethyl ether and water-saturated butanol. By chromatography of the ethereal extract on a column of silica gel we isolated the following compounds, identifying them by the GLC method: fatty acid methyl esters, fatty acids [5], β-sitosterol, esters of β-sitosterol and fatty acids (palmitic and linoleic), 6-O-acyl derivatives of β-sitosterol glucoside, and β-sitosterol glucoside [6]. There is no information in the literature on the presence in *Panax ginseng* of β-sitosterol acylated at $C_3$ by palmitic and linoleic acids.

In studying the composition of the roots, we devoted our main attention to the ginsenosides. The butanolic extracts, which contained the total glycosidic fraction (TGF) ws chromatographed first on the hydrophobic sorbent Polikhrom-1, which freed it from sugars and amino acids, and then on silica gel (KSK) with elution by the solvnet system chloroform–methanol–water (50:6:1) and by similar systems of gradually increasing polarity. as a result of subsequent repeat chromatography, the following were isolated as the main components of the TGF and were identified by IR, $^1H$ and $^{13}C$ NMR spectroscopies, mass spectrometry, and high-performance liquid chromatography (HPLC) [7]: $Rg_1$ (1.38 mg/g of dry root), Re (1.31), Rf (0.3), Rc (0.61), $Rb_2$ (0.5), $Rb_1$ (4.15), Ro (0.38), and also, as minor components, Rd (0.016), NG-R2 (0.03), and Z-R1 (0.026), together with two methyl ethers of the glycosides Ro (0.19) and Z-R1 (0.096). The methyl ether of Ro has been isolated previously from the roots of *Panax japonicus*. C. A. Mey.; however, this could with high probability be ascribed to an artifact. This is the first time that ginsenosides NG-R2 and Z-R1 have been isolated from the roots of *Panax ginseng*.

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