and *C. kirpicznikovii* Fed., the area of which is formed by the northern slopes of the Central Caucasus [1, 2].

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FERUCRIN ISOBUTYRATE AND FERUCRINONE FROM *Ferula foetidissima*

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UDC 547.58+633.88+54.5

A substance (I) with the composition $C_{28}H_{38}O_6$, M^+ 470, mp 183-195°C has been isolated by chromatography on silica gel in petroleum ether–ethyl acetate from a acetone extract of the fruit of *Ferula foetidissima* Regel. et Schmalh. collected in the Shakhdarinskii range close to the village of Khorog (samples No. 81-9). According to its UV spectrum, (I) is a coumarin derivative with an alkoxy substituent in position 7 (λ_{max}^{EtOH} 216.5; 242; 253; 324 nm; log ε 4.17; 3.47; 3.27; 4.21).

The substance contained a tertiary hydroxy group (3510 cm^{-1} band in the IR spectrum). The PMR spectrum exhibited, in addition to the signals of umbelliferone in the 6.1-7.7 ppm region, the signals of the protons of a terpenoid moiety [1.10, s, 6 H, $(CH_3)_2C$; 1.33, s, 3 H, $CH_3-\underset{|}{\overset{|}{C}}-$; 1.42, s, 3 H, CH_3-C-O; and 4.12, u.s., 2 H, CH_2-O-Ar] close in position and nature to the signals in the spectrum of ferucrin (II) [1]. However, unlike ferucrin, in the spectrum of which there is the signal of a proton geminal to a hydroxy group (3.15 ppm, m, ΣJ = 15.5 Hz, 1 H, CH–OH), in the spectrum of (I) there was the signal of a proton (4.44 ppm, m, ΣJ = 15.5 Hz, 1 H, HC-acyl) geminal to an alkoxy group and the characteristic signals of an isopropyl group (1.17 and 1.20 ppm, d, J = 7 Hz, 3 H each $(CH_3)_2-CH-COO$; 2.52 ppm, m, 1 H, $(CH_3)_2-CH-COO$.

Thus, on the basis of these results it may be assumed that (I) was ferucrin isobutyrate. The acylation of ferucrin with isobutyryl chloride gave a substance $C_{28}H_{38}O_6$, mp 193-195°C, identical according to its PMR and IR spectra with the isolated compound (I); a mixture of (I) with the synthetic specimen of ferucrin isobutyrate gave no depression of the melting point.

A terpenoid coumarin $C_{24}H_{30}O_5$, M^+ 398, mp 221-223°C, was isolated by chromatography under the same conditions from an acetone extract of the fruit of another sample *Ferula foetidissima* collected in the area of the Alai range in the valley of the R. Gar, close to the village of Urdush (No. 81–76). According to its UV, IR, and PMR spectra the substance was identical with ferucrinone (III), obtained previously by the oxidation of deacetylkellerin [2] and of ferucrin [3, 4]. This is the first time that ferucrinone has been isolated from a plant source.

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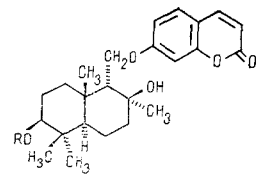
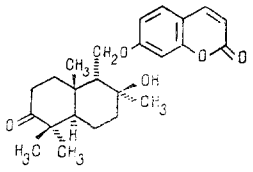


I. R = $(CH_3)_2CHCO$

II. R = H



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COUMARINS OF THE ROOTS OF *Heracleum aconitofolium* AND *H. grandiflorum*

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UDC 547.9:582.89

The fruit of *Heracleum aconitofolijm* Woronow and *H. grandiflorum* Stiven, has been investigated previously for the presence of coumarins [1, 2]. In the present communication we give the results of the isolation and quantitative determination of the main coumarins of the roots of these species.

On quantitative determination by a method developed previously [3] it was found that the roots of *H. aconitofolium* and *H. grandiflorum* contained 6.88% and 2.1%, respectively of total coumarins.

The coumarins were isolated by the following procedure. The comminuted raw material was extracted with ethanol, the extract was evaporated until the solvent had been driven off, and the residue was treated with chloroform. The coumarins of the chloroform fraction were separated on a column of acidic alumina [4] with elution by diethyl ether.

As a result, 10 substances of coumarin nature were isolated and identified and the amounts of the main representatives in the raw material were determined. From the roots of *H. aconitofolium* were obtained sphondin ($C_{12}H_8O_4$, mp 189-191°C, amount in the raw material 0.51%), bergapten ($C_{12}H_8O_4$, mp 189-190°C, 0.28%), xanthotoxin ($C_{12}H_8O_4$, mp 145-146°C), imperatorin ($C_{16}H_{14}O_4$, mp 102-103°C, 0.32%), biacangelicin ($C_{17}H_{18}O_7$, mp 117-118°C, [α] +24°C in absolute ethanol). From the roots of *H. grandiflorum* we isolated sphondin (0.35%), isobergapten ($C_{12}H_8O_4$, mp 223-224°C), pimpinellin ($C_{13}H_{10}O_5$, mp 116-117°C), psoralen ($C_{11}H_6O_3$, mp 161-163°C), bergapten (0.18%), xanthotoxin (0.27%), heraclesol [$C_{17}H_{18}O_7$, mp 117-118°C, [α] −30° (methanol)], and biacangelicin.

The substances isolated were identified from their physicochemical properties, IR spectra, and mixed melting points with authentic samples. In the quantitative determination of the coumarins, xanthotoxin was used as a standard.

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