

Plants of the genus *Ferula* (family Umbelliferae) contain coumarin derivatives, sesquiterpene lactones, and esters [1]. The raw material for our investigations consisted of the roots of *Ferula xeromorpha* Korov. collected in the mountains of the Alimtau, Chimkent oblast.

An ethanolic extract from the roots, after concentration, was chromatographed on a column of KSK silica gel, which was washed with petroleum ether-ethyl acetate (9:1) and with mixtures containing an increasing concentration of the second component, 500-ml fractions being collected. Compounds (I) and (II) were isolated from fractions 3-13 of the eluent.

Compound (I), with the composition  $C_{21}H_{24}O_7$ , mp 85-87°C,  $[\alpha]_D^{24} + 26^\circ$  (c 1.0; chloroform) dissolves readily in chloroform and carbon tetrachloride, sparingly in ethanol, and is insoluble in water.

The presence in the IR spectrum of the lactone isolated of bands at 1734  $cm^{-1}$  (carbonyl of an  $\alpha$ -pyrone), 1620, 1580, and 1490  $cm^{-1}$  (aromatic nucleus), 1235, 1320, and 1107  $cm^{-1}$  ( $\alpha, \beta$ -unsaturated ether), and 930  $cm^{-1}$  (gem-dimethyl group in a pyrone ring) permitted the substance to be assigned to the dihydropyranocoumarins, and a broad carbonyl band showed the presence of an acyloxy grouping. The presence in the NMR spectrum of characteristic signals of the protons of pyran and aromatic nuclei showed that its structure was based on a 7,8-disubstituted coumarin nucleus. The correctness of the conclusion concerning the nucleus of the substance under investigation was confirmed by the results of a chemical investigation. Alkaline hydrolysis yielded a hydroxylactone with the composition  $C_{15}H_{16}O_5$ , mp 160-162°C (MeOH),  $[\alpha]_D^{24} + 2.0$  (c 0.5; chloroform). On the basis of correspondence of the IR spectrum of an authentic sample and the absence of a depression of the melting point, the compound was identified as trans-methylkhellactone. In a hydrolyzate, paper chromatography showed the presence of acids with  $R_f$  0.60 and 0.35, corresponding to acetic and  $\alpha$ -methylbutyric acids (markers). Consequently, the lactone under consideration is an ester of khellactone with  $\alpha$ -methylbutyric and acetic acids. Literature information, and also a comparison of physicochemical constants (mixed melting point with an authentic sample) showed that the lactone isolated had the structure of 4'-acetoxy-3'- $\alpha$ -methylbutyloxydihydroxyseselin and is therefore identical with visnadin [2].

Compound (II), with the composition  $C_{14}H_{14}O_4$ , mp 183-185°C,  $[\alpha]_D^{24} + 4.2^\circ$  (c 0.4; chloroform), dissolves readily in chloroform and less readily in ethanol. The IR spectrum has absorption bands at 3500  $cm^{-1}$  (hydroxy group), 2880-2970  $cm^{-1}$  (methyl and methylene groups), and 1740  $cm^{-1}$  (C=O of an  $\alpha$ -pyrone). By a comparison of IR and NMR spectra and a mixed melting point with an authentic sample, substance (II) was identified as xanthogalol [3].

Coumarins [4] and furocoumarins [5] have been found previously in plants of the genus *Ferula*, but we are the first to have found pyranocoumarin derivatives.

## LITERATURE CITED

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