COMPONENTS OF THE ROOTS OF Ferula pallida

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Continuing a study of phenolic compounds of plants of the family Umbelliferae, from the roots of Ferula pallida Eug. Kor. collected in the Tashkent oblast (environs of the village of Zarkent) by chromatography of a methanolic extract on a column of KSK silica gel and elution with chloroform we have isolated three esters – A, B, and C – with R_f 0.49, 0.55, and 0.68 (ethyl acetate–petroleum ether (1 : 3) system; spots revealed with vanillin–sulfuric acid [14]).

Substance A had the composition $C_{18}H_{24}O_4$ (M^+ 304), mp 85-86°C, $[\alpha]^{22}_{D}$ $-41.7°$ (c 1.5; ethanol), R_f 0.68. When it was heated with 5% caustic potash solution, an alcohol with a camphor-like odor, $C_{10}H_{18}O$, mp 203°C, $[\alpha]^{22}_{D}$ $-39°$ (c 1.12; ethanol), and an acid $C_8H_8O_4$ with mp 205-206°C were obtained. It was shown by a comparison of physicochemical constants and IR spectra of the alcohol and the acid that they were, respectively, *l*-borneol and vanillic acid, and the starting material was *l*-chimganin (d-chimganin has been isolated previously from Ferula tschimganica Lipsky [1]).

Substance B had the composition $C_{22}H_{30}O_4$ (M^+ 358), mp 189-190.5°C, $[\alpha]^{23}_{D}$ $-91.6°$ (c 1.2; chloroform), and has been given the name ferolin; it is readily soluble in alcohols, sparingly soluble in chloroform and ether, and insoluble in water.

Its UV spectrum has a maximum at 262 nm (log ε 4.18) which shows the presence of a benzene nucleus in the molecule, and in the IR spectrum there are absorption bands at 1615, 1595, and 1520 cm^{-1} (aromatic ring), 1680, 1240, 1290, and 1105 cm^{-1} (carbonyl of an ester of an unsaturated acid), and 3420–3100 cm^{-1} (hydroxy group). The presence of a free phenolic hydroxy group was confirmed by a 45-nm bathochromic shift of the maximum in the UV spectrum in the presence of alkali, with an increase in log ε to 4.54.

Hydrolysis of the substance with 5% caustic potash gave an alcohol $C_{15}H_{26}O_2$ (M^+ 238), mp 136-137°C, $[\alpha]^{23}_{D}$ $-86°$ (c 0.9; ethanol), and an acid $C_7H_6O_3$ (M^+ 138) with mp 210-212°C. On the basis of a mixed melting point and IR spectroscopy, the latter was identified as p-hydroxybenzoic acid.

The IR spectrum of the alcohol had absorption bands at 3200-3600 cm^{-1} (hydroxy group), 1380-1465 cm^{-1} (gem-dimethyl group), and 1665 cm^{-1} (double bond). Its hydrogenation in acetic acid over PtO_2 (according to Adams) gave a dihydro derivative with mp 214-216°C.

In composition, melting point, and specific rotation, and also in the melting point of the dihydro derivative, the terpenoid alcohol obtained on saponification corresponded to the sesquiterpene alcohol angrendiol isolated previously from Ferula angrenii, F. prangifolia, F. ceratophylla, and F. karategina [5].

Substance C had the composition $C_{23}H_{32}O_5$ (M^+ 388), mp 140-141°C, $[\alpha]^{23}_{D}$ $-97.9°$ (c 1.2; chloroform), R_f 0.55. The results of a comparison of its physicochemical constants, IR spectra, and the products of alkaline hydrolysis permitted it to be identified as chimganidin [6].

Thus, the terpenoid alcohols – borneol and angrendiol – present in Ferula pallida exist in the form of esters and, according to results of thin-layer chromatography, are absent from the plants in the free state.

From the NMR spectra it may be concluded that ferolin is a monoester of angrendiol (at the secondary hydroxyl).

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