The carotenoid complex of the grape includes 17 individual pigments (Table 1). The largest amount of them is contained in the skin and the smallest amount in the seeds. On the whole, the amounts of carotenoids in the grape are low, which permits it to be assigned to the group of carotenoid-poor fruits. However, the set of representative carotenoids in the grape is far more diverse than in the leaves of many green plants [4]. A feature of the grape is its high relative content of β-carotene as compared with the majority of fruits. The flesh is characterized by the widest set of pigments, and the seeds by the narrowest. The composition of the pigments of the skin is similar to that of the leaves of green plants.

The seeds contain a comparatively large amount of colorless carotenoids (phytoene, phytofluene) which are precursors in the biosynthesis of the carotenes [4]. The composition of the xanthophylls in the seeds is far less diverse than in the flesh and skin.

The predominant carotenoids of the grape are lutein, violaxanthin, β-carotene, lycopene, and neoxanthin. The composition and ratio of the groups of carotenoids in the different white and red varieties of the grape are similar, on the whole. However, in the red varieties the amount of xanthophylls is smaller which is probably connected with the presence in them of a large number of antioxidants of the phenolic type which are capable of inhibiting the oxidative conversion of carotenes into xanthophylls. There is an average of 30% more carotenes in the red varieties than in the white. Of the carotenoids identified, α-, β-, and γ-carotenes, cryptoxanthin, and hydroxy-α-carotene are vitamin-active.

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AROMATIC ESTERS OF THE ROOTS OF *Ferula dissecta*

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Ferula dissecta (Ledeb.) Ledeb. is one of the species from the section Peucedanoides Boiss. that grows widely in eastern and south-eastern Kazakhstan, in the south of Siberia, and also in the adjacent regions of Mongolia and China. The terpenoid compounds of this species have not been investigated previously. From the roots of *F. dissecta* collected in the environs of the village of Kainararka (Alma-Ata province), we have isolated two substances (I and II). The roots (0.58 kg) were extracted three times with 6 liters of acetone, and the extracts were combined, filtered, and evaporated to dryness. This gave 85 g (14.7%) of resin, 10 g of which was chromatographed on alumina (column 120 × 3.5 cm; alumina of activity grade 4, neutral). The column was washed with hexane, with mixtures of hexane and chloroform in ratios of 9:1, 8:1, 7:1, 6:1, 5:1, 4:1, 3:1, 1:1, 1:3, 1:5, 1:6, 1:7, and 1:8, chloroform, mixtures of chloroform and ethyl acetate in ratios of 9:1, 7:1, 5:1, 3:1, 1:1, 1:3, 1:5, 1:7, and 1:9, and ethyl acetate. Fractions 14-15, eluted with hexane–chloroform (1:8), yielded substance (I) with the composition $C_{17}H_{22}O_3$, mp 156-157°C (from aqueous ethanol). Its IR spectrum contained the absorption bands of an OH group (3390 cm^{-1}), of a CO group of an α,β-unsaturated ester (1690, 1290 cm^{-1}), and of the C=C bonds of a benzene ring (1615, 1600, 1525 cm^{-1}). The acetylation of substance (I) led to a monoacetate with the composition

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*Deceased.

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$C_{19}H_{24}O_4$, mp 70-71°C (from aqueous ethanol). Its IR spectrum had the absorption bands of the CO groups of ester groups (1775, 1200, and 1725, 1300 cm^{-1}) and of the C=C bonds of a benzene ring (1610, 1510 cm^{-1}). The frequencies (1775, 1200 cm^{-1}) of the bands of a CO group of the newly formed ester indicated the phenolic nature of the OH group in the molecule of the compound under investigation. The NMR signal of substance (I) revealed two singlets in the 0.91 ppm region with areas of 3 and 6 protons corresponding to three tertiary methyl groups. A one-proton signal of eight lines (J = 9.9 Hz) at 5.1 ppm belonged to the geminal proton of an ester group. Doublets at 7.94 ppm (2H, J = 8.9 Hz) and 6.86 ppm (2H, J = 8.9 Hz) in the weak field of the spectrum are characteristic for a para-substituted benzene ring. A one-proton singlet at 6.35 ppm was due to the proton of a phenolic hydroxyl.

Saponification of the substance with 15% KOH solution led to a monoterpene alcohol with a camphorous smell having the composition $C_{10}H_{18}O$, mp 199°C, which was identified by a comparison of IR spectra as 1-borneol and p-hydroxybenzoic acid ($C_7H_6O_3$, mp 202-203°C).

Thus, substance (I) is an ester of borneol and p-hydroxybenzoic acid identical with *l*-chimgin [1]. The IR spectra of samples compared coincided in detail.

From fractions 21 and 22, eluted by chloroform—ethyl acetate (3:1 and 1:1), we isolated a substance II with the composition $C_{18}H_{24}O_4$, mp 84-86°C (from aqueous ethanol). The IR spectrum of (II) had the bands of an OH group (3400 cm^{-1}) and of the C=C bonds of a benzene ring (1610, 1600, 1522 cm^{-1}). Acetylation gave a monoacetate with the composition $C_{20}H_{26}O_5$, mp 115-116°C, the IR spectrum of which contained the CO bands of ester groups (1775, 1200, and 1720, 1300 cm^{-1}) and of the C=C bonds of a benzene ring (1610, 1515 cm^{-1}). In the NMR spectra there were singlet signals at 0.91, 0.92, and 0.97 ppm, which are characteristic for three methyl groups, and a signal at 3.94 ppm belonging to a methoxy group. In the weak field of the spectrum, there were one-proton doublets at 7.65 ppm (J = 9 Hz) and 6.94 ppm (J = 9 Hz) and at 7.5 ppm (J = 1.5 Hz). Each component of the doublet at 7.65 ppm was split additionally into a doublet with a spin-spin coupling constant of 1.5 Hz. Consequently, the signals at 7.65 and 7.56 ppm belong to meta-interacting protons. A singlet signal at 6.22 ppm belonged to the proton of a phenolic hydroxyl. A doublet at 5.08 ppm (J = 10 Hz) with secondary splitting of each component (into quartets) was due to a hemi-ester methine proton.

A comparison of the NMR spectra of substances (I) and (II) showed that (II) differed from (I) by the presence of an additional methoxy group. The saponification of substance (II) by the usual method gave vanillic acid ($C_8H_8O_4$, mp 204-205°C) and *l*-borneol ($C_{10}H_{18}O$, mp 119°C). A comparison of the IR spectra of substance (II) and of *l*-chimganin [2] showed their identity.

IR spectra were taken on a UR-20 spectrometer in paraffin oil, the NMR spectrum of substance (I) on a Bruker-90 spectrometer, and that of substance (II) on a Bruker 360 MHz spectrometer.

Thus, in its chemical composition, *F. dissecta* is close to a number of species of the section Peucedanoides studied previously —*F. lapidosa* and *F. tschimganica*, which contain identical or similar terpene esters.

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