CAROTENOIDS OF THE GRAPE

Yu. L. Zherebin and A. A. Kolesnik

UDC 577.161.077.22

We have investigated the composition and amount of carotenoids in the skin, flesh, and seeds of ripe grapes of the cultivated grapevine *Vitis vinifera* L. of white (Aligoté, Chaselas, Riesling), and red (Cabernet, Golubok, Odesskii chernyi) varieties.

The carotenoids were isolated from homogenates of the component elements of the grape by a modified Bligh-Dyer method [1]. The yellow pigments were freed from accompanying chlorophylls and lipids by saponification with subsequent elimination of the sterols by holding at −10°C [2]. The purified extract of carotenoids was separated with the aid of column and thin layer chromatography, successively [3].

To stabilize the carotenoids against oxidation during chromatography, ethoxyquin (500 mg/100 ml) was added to the developing solvent. Pigments were detected visually from their coloration or, in the case of the colorless fractions, by staining with iodine vapor [2]. The carotenoids were identified on the basis of characteristic maxima on the absorption curves in the 200–700 nm region, the colors of the pigments on the adsorbents and in solutions, the arrangement of the zones on the chromatograms [3], chromatography together with markers, and the performance of specific color reactions [2].

Quantitative determination was carried out by spectrophotometry using known specific extinction coefficients [4, 5].

TABLE 1. Relative Amounts (on the total mass) of Carotenoids in Plants of Aligoté (Cabernet) Grapes

Carotenoids	Flesh	Skin	Seeds
	I. Carbohydrates		
Phytoene	0.9 (1,8)	0.4 (0.2)	14.2 (10.9)
Phytofluene	1.7 (6.6)	0.9 (0.5)	20.6 (27.2)
Lycopene	12.2 (15.3)	2,1 (2,9)	8.3 (5.0)
α-Carotene	3.0 (4.6)	5.7 (7,4)	— (—)
β-Carotene	10,9 (16.1)	19.4 (26.3)	30,5 (34,3)
γ-Carotene	4.4 (5.0)	0.6 (1.5)	— (—)
	II. Monools		
Hydroxy-α-carotene	1.2 (—)	— (3,5)	— (—)
Cryptoxanthin	2,4 (1,7)	1,0 (2.1)	— (—)
	III. Diols		
Lutein	23 1 (18,5)	34,2 (26,4)	20,0 (14,3)
Zeaxanthin	5.8 (7.4)	4,1 (6.3)	(1.6)
	IV. Monoepoxide diols		
Lutein 5,6-epoxide	4,2 (3,3)	3,7 (2,1)	— (—)
Antheraxanthin	1,8 (—)	— (—)	— (—)
Lutein 5,8-epoxide	2,5 (4.7)	1,5 (0,6)	— (—)
Mutatoxanthin	1.1 (—)	— (—)	— (—)
	V. Diepoxide diols		
Violaxanthin	14,0 (11.2)	15,9 (13,5)	5,2 (4,2)
Luteoxanthin	2,3 (—)	0,5 (0.9)	— (—)
	VI. Monoepoxide triols		
Neoxanthin	8,5 (3.8)	10,0 (5,8)	1,2 (2,5)
Total amount, mg/kg	1,61 (2,68)	7,86 (16,35)	0,07 (0,16)

Physicochemical Institute, Academy of Sciences of the Ukrainian SSR, Odessa. Translated from Khimiya Prirodnykh Soedinenii, No. 1, pp. 111-112, January-February, 1984. Original article submitted April 27, 1983.

 0009-3130/84/2001-0110$08.50 © 1984 Plenum Publishing Corporation

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.

LITERATURE CITED

1. A. V. Bogatskii, Yu. L. Zherebin, and A. A. Kolesnik, Vinogradarstvo Vinodelie SSSR, 8, 26 (1978).
2. V. N. Karnaukhov, The Functions of Carotenoids in Animal Cells [in Russian], Moscow (1973), p. 104.
3. K. A. Buckle and F. M. M. Rahman, J. Chromatog., 171, 385 (1979).
4. Pigments of the Plastids of Green Plants and Methods for Their Investigation [in Russian], Moscow–Leningrad (1964), p. 121.
5. F. L. Kalinin, V. P. Lobov, and V. I. Zhidkov, Handbook on Biochemistry [in Russian], Kiev (1971), p. 1014.

AROMATIC ESTERS OF THE ROOTS OF *Ferula dissecta*

V. Yu. Bagirov,* S. V. Serkerov, N. F. Mir-Babaev, and M. G. Pimenov

UDC 547.914

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

*Deceased.

A. I. Karaev Institute of Physiology, Academy of Sciences of the Azerbaidzhan SSR, Baku. M. V. Lomonosov Moscow State University.

Translated from Khimiya Prirodnykh Soedinenii, No. 1, pp. 113-114, January-February, 1984. Original article submitted July 27, 1983.

0009-3130/84/2001-0111$08.50

© 1984 Plenum Publishing Corporation