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FLAVONOIDS OF *Astragalus virgatus*

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Continuing the search for biologically active substances in plants of the genus Astragalus, we have studied the flavonoid composition of the epigeal part of Astragalus virgatus Pall., collected on the territory of the Northern Caucasus in the flowering period.

The air-dry comminuted herbage was extracted with 70% ethanol in an apparatus of the Soxhlet type. The ethanol was distilled off, and the aqueous residue was purified with chloroform, after which the flavonoids were extracted with ethyl acetate. The ethyl acetate was distilled of and the residue was chromatographed on a column of polyamide sorbent. Seven individual flavonoids (1-7) were isolated.

Substance 1 – $C_{21}H_{20}O_{12}$, mp 238-241°C, $[\alpha]_D^{20}$ −69.2° (c 0.1; methanol); λ_{max}, nm: 363, 255 – quercetain 3-O-β-D-glucopyranoside, or isoquercitrin.

Substance 2 – $C_{21}H_{20}O_{11}$, mp 178-180°C, $[\alpha]_D^{20}$ −69° (c 0.48; methanol); λ_{max}, nm: 357, 265 – kaempferol 3-O-β-D-glucopyranoside, or astragalin.

Substance 3 – $C_{22}H_{22}O_{12}$, mp 172-174°C, $[\alpha]_D^{20}$ −30° (c 0.4; methanol); λ_{max}, nm: 357, 256 – isorhamnetin 3-O-β-D-glucopyranoside.

Substance 4 – $C_{21}H_{20}O_{11}$, mp 269-271°C, $[\alpha]_D^{20}$ −48.2° (c 0.1; ethanol); λ_{max}, nm: 365, 224 – kaempferol 7-O-β-D-glucopyranoside, or populnin.

Substance 5 – $C_{28}H_{32}O_{16}$, mp 183-185°C, $[\alpha]_D^{20}$ −38.2° (c 0.5; formamide); λ_{max}, nm: 358, 255 – isorhamnetin 3-O-[O-β-L-rhamnopyranosyl-(1 → 6)-β-D-glucopyranoside], or narcissin.

Substance 6 – $C_{15}H_{10}O_6$, mp 277-279°C; λ_{max}, nm: 370, 265 – kaempferol.

Substance 7 – $C_{15}H_{10}O_7$, mp 310-312°C; λ_{max}, nm: 370, 265, 256 – quercetin.

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The structures of all the compounds isolated were confirmed by the results of elementary analysis and of UV and IR spectroscopy, and by a study of the products of acid and enzymatic hydrolysis, and also by comparison with authentic samples.

Biological trials showed that the combined flavonoids from Astragalus virgatus caused a more pronounced lowering of the systemic arterial pressure in experiments on animals than an official preparation of papaverine hydrochloride.

CAROTENOIDS OF THE RIND OF CITRUS FRUITS

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In the preparation of preserves and confectioners' intermediates, citrus fruits are used together with the rind. The amount of carotenoids, which possess provitamin A activity, in the rind determines the biological value of these products.

We have investigated the rind of citrus fruits growing in the subtropical regions of the Georgian SSR. The total amount of carotenoids was determined as described in [1, 2] (mg per 100 g of dry matter):

Fruit	Carotenoid content	Fruit	Carotenoid content
Mandarins		Oranges	
Unshiu shirokolistnyi	13,3	Washington navel	8,6
Sochinskii	23,0	Mestnyii	11,2
Pioner 80	16,0	Gamlin,	9,2
Gruzinskii rannii	13,2	Pervenets	11,1
Sil verkhil'	12,4	Korolek	19,9
Krasnodarets 83	21,5	Grapefruit	
Lemons		Duncan	4,5
Novogruzinskii	2,5	Marsh seedless	3,6
Meyer	6,4	Pummelos	
		Pyriform shaddock	3,3

As we see, the rinds of lemons, grapefruits, and pummelos contain, on an average, 3.5 times less carotenoids than the rinds of mandarins and oranges.

We studied in detail the composition of the carotenoids of the rinds of mandarins of the Unshiu shirokolistnyi variety and oranges of the Mestnyi variety, the large-scale harvesting of which amounts to 90% of the total crop of this citrus fruits. The sum of the carotenoids of these samples were separated by column chromatography and thin layer chromatography [2] into individual components which were identified from their absorption curves in the visible part of the spectrum by chromatography of mixtures of samples from the zones isolated with model samples and from literature information [3, 4]. The amount of each cartenoid was determined spectrophotometrically [2]. The results obtained are given below.

The carotenoids of the rind of Unshiu mandarins (% of the total carotenoids): β-carotene, 15.0; γ-carotene, traces; prolycopene, 1.0; cryptoxanthin epoxide, 1.0; cryptoxanthin 15.0; violaxanthin, 35.0; mutatoxanthin, 12.0; violaxanthal, 1.0; the apocarotene of sintexanthin, 9.0; flavoxanthin, 1.0; unidentified carotenoids, 9.0.

Carotenoids of the rind of Mestnyi oranges (% of the total carotenoids): phytoene, 1.0; phytofluene, 1.0; γ-carotene, 1.0; β-zeacarotene, 1.0; mutatochrome (citroxanthin), 1.0; cryptoxanthin, 37.9; β-apo-8'-carotenal, 1.0; hydroxy-α-carotene, 1.3; β-apo-10'-carotenal, 1.0; sintaxanthin, 1.0; luteoxanthin, 1.0; auroxanthin, 1.0; trollixanthin, 39.1; unidentified carotenoids, 11.7.

Thus, the main carotenoids of mandarin rind are violoxanthin, β-carotene, cryptoxanthin, mutatoxanthin, and the apocarotene of sintaxanthin, and of orange rind cryptoxanthin and trollixanthin.

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