

A PHYTOCHEMICAL STUDY OF *Spinacia oleracea*

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The search for medicinal substances of natural origin affecting metabolic processes in the organism (enzymes, hormones, vitamins, microelements) is an urgent task in modern medicine. With this aim we have studied the chemical composition of prickly-seeded spinach *Spinacia oleracea* L., family Chenopodiaceae.

The epigeal part of the plant contains proteins, sugars [1, 2], ascorbic acid [3], vitamins B₁, B₂, P, K, E, and D [2, 4], carotenes [4, 5], and iron, magnesium, phosphorus, calcium, and iodine [1], while oxalic acid [1, 4], cellulose, and monosaccharides [3, 5] have been detected in the free state. We are the first to have detected and identified phenolic compounds in this plant.

We studied the epigeal part of prickly-seeded spinach collected in 1987 in Khar'kov province, Ukraine. The air-dry raw material (5.0 kg) was exhaustively extracted with aqueous ethanol by the reprecipitation method with division of the raw material into unequal parts - 2.5:1.5:1.

The extract obtained (5 liters) was evaporated in vacuum to a viscous residue, which was purified with chloroform and deposited on a column of polyamide sorbent. The column was washed with aqueous ethanol in increasing concentrations (10-96%). When the fractions obtained were rechromatographed on polyamide and silica gel, three flavonoid compounds (I-III) and four phenolic carboxylic acids (IV-VII) were isolated.

To identify the flavonoid substances we used the results of elementary analysis and chemical transformations (acetylation, acid and enzymatic hydrolysis), and also UV and IR spectroscopy and direct comparison with authentic specimens.

Substance I was rutin (quercetin 3-O-rutinoside), C₂₇H₃₀O₁₆, mp 187-189°C, [α]_D²⁰ -6° (c 0.1; methanol), UV spectrum: λ_{max} 362, 257 nm.

Substance II was hyperoside (quercetin 3-O-β-galactopyranoside), C₂₁H₂₀O₁₁, mp 232-234°C, [α]_D²⁰ -36.4° (c 1.08; formamide). UV spectrum: λ_{max}^{C₂H₅OH} 361, 257 nm.

Substance (III) was astragalín (kaempferol 3-O-β-D-glucopyranoside), C₂₁H₂₀O₁₁, mp 177-179°C, [α]_D²⁰ -69° (c 0.5, ethanol). UV spectrum: λ_{max}^{C₂H₅OH} 362, 265 nm.

The phenolic carboxylic acids (IV-VII) were identified by their chromatographic behavior, melting points, the results of alkaline fusion and hydrolysis, elementary analysis, and UV and IR spectra.

The following were identified by comparison with authentic samples: caffeic (IV), chlorogenic (V), neochlorogenic (VI), and protocatechuic (VII) acids.

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