FLAVONOIDS OF *Astragalus tana*

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UDC 547.972

In continuation of the study of the flavonoid content of *Astragalus* L. species, we investigated the aerial part of *Astragalus tana* L. (Fabaceae L.) collected during flowering in Kartli in Tana region (Georgia).

The extract was purified by the literature method [1]. Two-dimensional paper chromatography revealed at least six flavonoids. It was established preliminarily that the starting material contained mainly kaempferol glycosides. First the extract was fractionated on a polyamide column with elution by water, aqueous alcohol (45%), and alcohol (96%). Fraction 2 contained the bulk of the flavonoglycosides. Rechromatography on the column of this fraction produced **1**-**4**.

Compound **1**, $C_{21}H_{20}O_{11}$, mp 196-198°C (ethanol), $[\alpha]_D^{20}$ -19° (*c* 0.1, ethanol), λ_{max}^{EtOH} 375, 268 nm. A dilute acid solution hydrolyzes **1** to D-glucose and an aglycone with mp 273-275°C (methanol); mp of the acetate, 178-181°C. Alkaline decomposition, UV and IR spectra, and comparison with an authentic sample identified the compound as kaempferol. Comparison of the UV spectral data of the aglycone and glycoside indicated that D-glucose was bonded to C_3 of the aglycone. Compound **1** was identified as astragalin [2].

Compound **2**, $C_{27}H_{30}O_{15}$, mp 221-222°C, $[\alpha]_D^{20}$ -17.3° (*c* 0.345, ethanol—water, 1:1), λ_{max}^{EtOH} 355, 265 nm, ν_{max} (mineral oil, cm^{-1}): 3400-3100 (OH), 1670 (C=O, γ-pyrone). PMR spectrum (TMS ether, DMSO-d_6, δ, ppm): 8.04 (2H, d, J = 8 Hz, H-2′,6′), 6.96 (2H, d, J = 8 Hz, H-3′,5′), 6.41 (1H, d, J = 2 Hz, H-8), 6.18 (1H, d, J = 2 Hz, H-6), 5.30 (1H, d, J = 7 Hz, H-1 of D-galactose), 4.40 (1H, br. s, H-1 of L-rhamnose), 1.06 (3H, d, J = 6 Hz, CH_3 of L-rhamnose). The glycoside was cleaved by acid into kaempferol, D-galactose, and L-rhamnose; by the enzyme rhamnodiastase, into robinobiose and kaempferol. UV, IR, NMR spectra and the hydrolysis products characterize **2** as kaempferol-3-O-β-D-robinobioside [2].

Compound **3**, $C_{27}H_{30}O_{15}$, mp 200-205°C (ethanol), $[\alpha]_D^{20}$ -142.5° (*c* 0.1, ethanol—DMF, 1:1), λ_{max}^{EtOH} 352, 266 nm. Acid hydrolysis also gives kaempferol, D-glucose, and L-rhamnose; the enzyme rhamnodiastase cleaves it into kaempferol and rutinose. Compound **3** was identified as kaempferol-3-rutinoside (nicotiflorine) [2].

Compound **4**, $C_{33}H_{40}O_{19}$, mp 180-182°C (ethanol), $[\alpha]_D^{20}$-84° (*c* 0.1, ethanol), λ_{max} (mineral oil) 352, 255 nm. The compound has a bitter taste. It is hydrolyzed by H_2SO_4 (2%) for 5 min to give the aglycone kaempferol (30%), D-galactose, and L-rhamnose. It is not decomposed by rhamnodiastase and *Helix plectotropis*, produces an acetonide, and forms D-galactose upon periodate oxidation. The methylation products are identical to those of ascaside [3]. The results of UV and IR spectral analysis characterize **4** as kaempferol-3-O-β-D-galactopyranosyl-(3″,4″)-di-O-α-L-rhamnopyranoside (ascaside).

Flavonoids **1**-**4** were isolated from *Astragalus tana* L. for the first time.

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I. G. Kutateladze Institute of Pharmacochemistry, Academy of Sciences of Georgia. Translated from Khimiya Prirodnykh Soedinenii, No. 5, p. 425, September-October, 2000. Original article submitted April 27, 2000.

0009-3130/00/3605-0537$25.00