

ESTERS FROM *Ferula samarcandica*

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In continuation of research on terpenoid plants of the *Ferula* L. genus (Apiaceae), we studied components of the roots of Samarkand ferula (*Ferula samarcandica* Korov.) collected in Tashkent district. The terpenoid coumarins samarcandin and samarcandone were isolated previously from Samarkand ferula [1]. Later, a study of Samarkand ferula misidentified as mogoltav ferula (*F. mogoltavica* Lipsky ex Korov.) isolated the terpenoid coumarins samarcandin, samarcandone, mogoltadone, gummosin, and farnesiferol A [2-4].

Air-dried ground roots were extracted with ethanol. The alcohol extract was evaporated, diluted with water (1:2), and treated with ethylacetate. The combined ethylacetate extract was distilled to produce a thick extract that was placed on a column of KSK silica gel (d = 3 cm, h = 80 cm) and eluted by benzene:ethylacetate (9:1) with a subsequent increase of ethylacetate concentration. Fractions of 100 mL were collected. The separation of the total terpenoids was monitored using TLC (hydrocarbons:ethylacetate, 4:1; developer, 1% vanillin in conc. H₂SO₄).

Four terpenoid esters were isolated: **1**, C₁₇H₂₂O₃, mp 155-156°C; **2**, C₁₈H₂₄O₄, mp 84-85°C; **3**, C₁₈H₂₄O₄, [α]_D²² -30 (c 0.5, ethanol); **4**, C₂₂H₂₈O₅, mp 129-130°C.

Comparison of the PMR, UV, IR, and mass spectra of **1** and **2** with those in the literature identified them as tschimgin and tschimganin [5].

The IR spectrum (KBr, ν, cm⁻¹) of **3** exhibited absorption bands typical of hydroxyl (3534), ester carbonyl (1693), and an aromatic ring (1598, 1514) [6].

The mass spectrum of **3** was similar to that of esters of monoterpene alcohols and had peaks for ions with *m/z* 304 [M]⁺, 168 (C₈H₈O₄), 148, 123, 95, 93.

The PMR spectrum (100 MHz, DMSO-d₆, δ, ppm, J/Hz) of **3** exhibited signals at 0.70, 0.80, and 1.02 (each 3H, s), 3.65 (3H, s, OCH₃), 7.10 (1H, d, J = 9.0, H-3'), 7.72 (1H, d, J = 2, H-6'), 7.75 (1H, q, J₁ = 9.0, J₂ = 2, H-2'), 4.90 (1H, d, J₁ = J₂ = 7.5) and 5.15 (1H, br. d, J = 10). The two signals at 4.90 and 5.15 ppm in the range of geminal protons indicate that **3** is a natural mixture of tschimganin and *iso*-tschimganin. Similar mixtures of tschimgin/*iso*-tschimgin and tschimganin/*iso*-tschimganin were isolated from *F. dshizakensis* Korov. and *F. angreni* Korov. [7, 8].

The neutral part of the hydrolysate from base hydrolysis of **3** by aqueous KOH (5%) afforded a monoterpene alcohol of composition C₁₀H₁₈O with mp 201-202°C that was identified as borneol [5].

Comparison of the PMR, IR, and mass spectra of **4** with those of known carotane esters showed that this compound was lancerodiol *p*-hydroxybenzoate, which was isolated earlier from *F. lancerottensis* [9].

Thus, it is found for the first time that Samarkand ferula contains esters of terpenoid alcohols in addition to terpenoid coumarins.

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