FLAVONOIDS OF PLANTS FROM THE GENUS *Tamarix*

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The flavonoid composition of plants is one of the adaptive variables in their adjustment to environmental conditions [1]. Therefore, an investigation of the polyphenol composition of plants from the genus *Tamarix* (Tamaricaceae), which are halophytes (salt tolerant plants), is considered timely [2].

This communication continues an earlier study of *Tamarix elongata* Ledeb. and *T. laxa* Will. (aerial part) that were collected in the Aral and Almaty regions during flowering [3, 4]. Quantitative analysis showed 1.45 and 1.50% flavonoids, respectively.

Compounds **1**-**9** were isolated by adsorption-distribution (silica gel, polyamide) and gel chromatography (Sephadex, LH-20) from the ethylacetate fraction and aqueous remainder.

Chemical (acid hydrolysis, alkaline destruction, anthocyanidine test) and spectral (UV, IR, mass, PMR, 2D NMR HMBC spectroscopies) data and a comparison with the literature identified **1**-**9** as 7,3′,4′-trihydroxy-5-methoxyflavone (**1**), 3,7,4′-trihydroxy-5-methoxyflavone (**2**), 3,5,7-trihydroxy-3′,4′-dimethoxyflavone (**3**), kaempferide 3-O-β-glucopyranoside (**4**), quercetin 3-O-β-glucopyranoside (**5**), quercetin 3-O-sulfate (**6**), isorhamnetin 3-O-β-glucopyranoside (**7**), isorhamnetin 7-O-sulfate (**8**), and tamarixetin 3-O-α-rhamnopyranoside (**9**).

Compounds **5** and **6** were isolated previously from *T. hispida* [3] and *T. aplexicaulis* [5]. Compounds **1**-**3** and **7**-**9** were isolated for the first time from plants of the genus *Tamarix* and the Tamaricaceae family.

7,3′,4′-Trihydroxy-5-methoxyflavone (1), mp 304-306°C. UV spectrum (MeOH, λ_{max}, nm): 366, 267; +CH_3COONa: 370, 270; +CH_3COONa + H_3BO_3: 377, 268; +$AlCl_3$: 424, 270; +$AlCl_3$ + HCl: 363, 268; +NaOMe: 385, 267.

PMR spectrum (500 MHz, $CDCl_3$, δ, ppm, J/Hz): 3.88 (3H, s, –OCH_3), 6.12 (1H, s, H-3), 6.27 (1H, d, J = 2.0, H-6), 6.44 (1H, d, J = 2.0, H-8), 7.70 (1H, d, J = 8.0, H-5′), 8.15 (1H, dd, J = 2.0, 8.0, H-6′), 8.24 (1H, d, J = 2.0, H-2′).

Mass spectrum (EI, 70 eV, *m*/*z*, I_{rel}, %): 300.0 (100.0), 285.0 (19.8), 259 (4.0), 188.9 (13.2), 152.8 (20.2), 136.9 (19.6), 55.0 (4.8), $C_{16}H_{12}O_6$ [6].

3,7,4′-Trihydroxy-5-methoxyflavone (2), mp 240-242°C. UV spectrum (MeOH,λ_{max}, nm): 354, 266; +CH_3COONa: 367, 268; +CH_3COONa +H_3BO_3: 364, 267; +$AlCl_3$: 423, 269; +$AlCl_3$ + HCl: 423, 269; +NaOMe: 375, 271.

PMR spectrum (400 MHz, CD_3OD, δ, ppm, J/Hz): 3.86 (3H, s, –OCH_3), 6.27 (1H, d, J = 2.0, H-6), 6.39 (1H, d, J = 2.0, H-8), 7.05 (2H, d, J = 8.0, H-3′,5′), 8.17 (2H, d, J = 8.0, H-2′,6′).

Mass spectrum (EI, 70 eV, *m*/*z*, I_{rel}, %): 300.0 (100.0), 285.2 (41.5), 135.1 (13.6), 107.1 (3.6), $C_{16}H_{12}O_6$ [7].

3,5,7-Trihydroxy-3′,4′-dimethoxyflavone (3), mp 267-270°C. UV spectrum (MeOH, λ_{max}, nm): 352, 260; +CH_3COONa: 351, 268; +CH_3COONa + H_3BO_3: 350, 269; +$AlCl_3$: 389, 270; +$AlCl_3$ + HCl: 350, 266; +NaOMe: 389, 266.

PMR spectrum (400 MHz, CD_3OD, δ, ppm, J/Hz): 3.84 (3H, s, OCH_3), 3.88 (3H, s, OCH_3), 6.23 (1H, d, J = 2.0, H-6), 6.45 (1H, d, J = 2.0, H-8), 7.06 (1H, d, J = 8.0, H-5′), 7.65 (1H, d, J = 2.0, H-2′), 8.24 (1H, dd, J = 2.0, 8.0, H-6′).

Mass spectrum (EI, 70 eV, *m*/*z*, I_{rel}, %): 330.0 (100), 316.0 (15.7), 300.0 (16.7), 287.0 (15.1), 273.0 (12.6), 229.0 (2.1), 165.0 (7.3), 150.5 (3.3), 136.0 (13.5), 108.0 (2.2), 58.1 (3.0), $C_{17}H_{14}O_7$ [8].

Kaempferide-3-O-β-glucopyranoside (4), mp 230-232°C. UV spectrum (EtOH, λ_{max}, nm): 355, 271; +CH_3COONa: 327, 274; +CH_3COONa + H_3BO_3: 340, 268; +$AlCl_3$: 365, 277; +$AlCl_3$ + HCl: 363, 275; +NaOMe: 345, 253.

PMR spectrum (300 MHz, CD_3OD, δ, ppm, J/Hz): 3.85 (3H, s, OCH_3), 7.03 (1H, d, J = 2.0, H-6), 7.10 (1H, d, J = 2.0, H-8), 7.63 (2H, d, J = 8.0, H-3′,5′), 7.73 (2H, d, J = 8.0, H-2′,6′), 4.96 (1H, d, J = 2.0, H-1″), 3.55-3.40 (5H, m, H-2″, H-3″, H-4″, H-5″, H-6″), $C_{22}H_{22}O_{11}$ [9].

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Isorhamnetin-3-O-β-glucopyranoside (7), mp 220-222°C. UV spectrum (MeOH, λ_{max}, nm): 357, 257; +CH_3COONa: 359, 258; +CH_3COONa + H_3BO_3: 359, 260; +$AlCl_3$: 414, 272; +$AlCl_3$ + HCl: 401, 269; +NaOMe: 365, 267.

PMR spectrum (400 MHz, CD_3OD, δ, ppm, J/Hz): 3.91 (3H, s, OCH_3), 6.19 (1H, d, J = 2.0, H-6), 6.38 (1H, d, J = 2.0, H-8), 6.86 (1H, d, J = 8.0, H-5′), 7.50 (1H, dd, J = 2.0, 8.0, H-6′), 7.90 (1H, d, J = 2.0, H-2′), 4.88 (1H, d, J = 7.0, H-1″), 3.46-3.30 (6H, m, H-2″, H-3″, H-4″, H-5″, H-6″).

Mass spectrum (EI, 70 eV, *m*/*z*, I_{rel}, %): 464.8, $C_{22}H_{22}O_{12}$ [10].

Isorhamnetin-7-O-sulfate (8), mp 266-268°C. UV spectrum (MeOH, λ_{max}, nm): 344, 263; +CH_3COONa: 350, 256; +CH_3COONa + H_3BO_3: 352, 256; +$AlCl_3$: 410, 272; +$AlCl_3$ + HCl: 346, 264; +NaOMe: 365, 267.

PMR spectrum (400 MHz, D_2O, δ, ppm, J/Hz): 3.93 (3H, s, OCH_3), 6.05 (1H, d, J = 2.0, H-6), 6.23 (1H, d, J = 2.0, H-8), 6.72 (1H, d, J = 8.0, H-5′), 7.25 (1H, dd, J = 2.0, 8.0, H-6′), 7.30 (1H, d, J = 2.0, H-2′).

Mass spectrum (EI, 70 eV, *m*/*z*, I_{rel}, %): 393.4 (10.0), 315.0 (100.0), 272.7 (10.0), 259 (4.0), 188.9 (13.2), 152.8 (20.2), 136.9 (19.6), 55.0 (4.8), $C_{16}H_{12}O_{10}S$ [11] .

IR spectrum (KBr, ν_{max}, cm^{-1}): 3410 (OH), 2924, 1644, 1607, 1269 (S=O), 1193 (S=O), 1049 (C–O–S),.

Tamarixetin-3-O-α-rhamnopyranoside (9), mp 296-298°C. UV spectrum (MeOH, λ_{max}, nm): 357, 257; +CH_3COONa: 360, 259; +CH_3COONa + H_3BO_3: 360, 260; +$AlCl_3$: 400, 269; +$AlCl_3$ + HCl: 356, 257; +NaOMe: 380, 264.

PMR spectrum (500 MHz, CD_3OD, δ, ppm, J/Hz): 3.93 (3H, s, OCH_3), 5.83 (1H, d, J = 2.0, H-6), 6.48 (1H, d, J = 2.0, H-8), 7.05 (1H, d, J = 8.0, H-5′), 7.16 (1H, d, J = 2.0, H-2′), 7.50 (1H, dd, J = 2.0, 8.0, H-6′), 4.94 (1H, d, J = 2.0, H-1″), 3.75-3.41 (5H, m, H-2″, H-3″, H-4″, H-5″), 1.20 (1H, d, J = 6.0, H-6″).

Mass spectrum (EI, 70 eV, *m*/*z*, I_{rel}, %): 462.7 (3.3), 315.9 (100.0), 152.8 (20.1), 137.9 (6.2), 55.9 (21.8), $C_{22}H_{22}O_{11}$ [12].

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