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FLAVONOIDS OF *Broussonetia papyrifera*

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Broussonetia papyrifera (Linn.) Vent, belonging to the family Moraceae, is a deciduous tree or shrub that grows naturally in Asian and Pacific countries such as China, Thailand, and the USA. The roots, barks, and fruits are all used in Chinese traditional and herbal drugs, and the fruits have been used for treatment of impotence and ophthalmic disorders in China [1].

The 5.2 kg dried leaf powder of *B. papyrifera* collected from Qinling Mountain, Shaanxi, China in July 2006 was extracted exhaustively with 95% ethanol at room temperature. The ethanol extract was evaporated in vacuum at 60°C to give a residue. The residue was suspended in water and successively treated with petroleum ether, ethyl acetate, and *n*-butanol.

The *n*-butanol extract (44 g) was subjected to chromatography on silica gel eluting successively with chloroform-methanol gradient (1:0, 20:1, 10:1, 20:3, 5:1, 2:1, 1:1, 0:1) to give eight fractions (I–VIII). Repeated chromatography of fractions IV and V on silica gel eluting with a gradient of methanol in chloroform and Sephadex LH-20 with chloroform–methanol (1:1) afforded compounds **1** (480 mg) and **2** (170 mg). The ethyl acetate extract (13.73 g) was processed with the same chromatography to afford compound **3** (140 mg). The structures of these compounds were confirmed using UV, IR, and NMR spectra and by comparison with reported spectral data in the literature.

Apigenin-7-*O*-β-D-glucopyranoside (1): $C_{21}H_{20}O_{10}$, mp 229–232°C, UV (MeOH, λ_{max}, nm): 255, 267, 350. The IR spectrum (KBr, ν, cm^{-1}) shows characteristic absorption bands of hydroxyls (3420), carbonyl of γ-pyrone (1657), aromatic ring (1572, 1509, 834), and C-O of glycoside (1092, 1040). ^{1}H NMR (300 MHz, DMSO-d$_6$, δ, ppm, J/Hz): 12.97(1H, s, OH-5), 10.39 (1H, s, OH-4′), 7.96 (2H, d, J = 8.7, H-2′, 6′), 6.97 (2H, d, J = 8.7, H-3′, 5′), 6.87 (1H, s, H-3), 6.83 (1H, d, J = 2.0, H-8), 6.46 (1H, d, J = 2.0, H-6), 5.08 (1H, d, J = 7.3, H-1″), 4.63~5.41 (4H, m, Glc-OH), 3.20~3.76 (6H, m, Glc-H). ^{13}C NMR (75 MHz, DMSO-d$_6$, δ, ppm): 181.8 (C-4), 164.8 (C-2), 163.5 (C-7), 161.9 (C-5), 161.6 (C-4'), 157.4 (C-9), 129.1 (C-2′, 6′), 120.5 (C-1′), 116.5 (C-3′, 5′), 105.4 (C-10), 103.6 (C-3), 100.5 (C-1″), 100.0 (C-6), 95.4 (C-8), 77.7 (C-5″), 77.0 (C-3″), 73.6 (C-2″), 70.1 (C-4″), 61.1 (C-6″) [2, 3].

Luteolin-7-*O*-β-D-glucopyranoside (2): $C_{21}H_{20}O_{11}$, mp 257–259°C, UV (MeOH, λ_{max}, nm): 255, 267, 349. ^{1}H NMR (300 MHz, DMSO-d$_6$, δ, ppm, J/Hz): 7.47(1H, dd, J = 8.2, 2.0, H-6′), 7.43 (1H, d, J = 2.0, H-2′), 6.94 (1H, d, J = 8.2, H-5′), 6.81 (1H, d, J = 2.0, H-8), 6.73 (1H, s, H-3), 6.46 (1H, d, J = 2.0, H-6), 5.07 (1H, d, J = 7.5, H-1″), 4.62~5.34 (4H, m, Glc-OH), 3.20~3.75 (6H, m, Glc-H). ^{13}C NMR (75 MHz, DMSO-d$_6$, δ, ppm): 181.8 (C-4), 164.9 (C-2), 163.4 (C-7), 161.2 (C-5), 157.4 (C-9), 150.1 (C-4′), 146.0 (C-3′), 121.9 (C-1′), 119.7 (C-6′), 116.4 (C-5′), 113.9 (C-2′), 105.8 (C-10), 103.7 (C-3), 100.4(C-1″), 100.0 (C-6), 95.4 (C-8), 77.5 (C-3″), 76.6 (C-5″), 73.4 (C-2″), 70.0 (C-4″), 61.0 (C-6″) [4].

Luteolin (3): $C_{15}H_{10}O_6$, mp 328–330°C, UV (MeOH, λ_{max}, nm): 251, 264, 350. ^{1}H NMR (DMSO-d$_6$, 300 MHz, δ, ppm, J/Hz): 7.42(1H, d, J = 2.2, H-2′), 7.40 (1H, dd, J = 2.2, 8.2, H-6′), 6.92 (1H, d, J = 8.2, H-5′), 6.88 (1H, s, H-3), 6.49 (1H, J = 2.1, H-8), 6.23 (1H, d, J = 2.1, H-6). ^{13}C NMR (75 MHz, DMSO-d$_6$, δ, ppm): 182.0 (C-4), 164.4 (C-7), 161.6 (C-5), 157.8 (C-9), 149.9 (C-4′), 146.0 (C-3′), 122.4 (C-1′), 119.5 (C-6′), 116.5 (C-5′), 113.7 (C-2′), 104.2 (C-10), 103.4 (C-3), 99.2 (C-6), 94.4 (C-8) [5].

Flavonoids **1** and **2** were isolated for the first time from *B. papyrifera*, the first time these flavonoids were isolated from this genus.

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