FLAVONOIDS FROM *Centaurea sulphurea*

A. Kabouche,[1*] Z. Kabouche,[1]
R. Touzani,[2] and C. Bruneau[3]

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Flavonoids and sesquiterpene lactones have a wide occurrence in *Centaurea* (Asteraceae) [1–5]. Plants of this genus are used to treat inflammations, cardiovascular ailments, microbial infections, and ulcers [6–8]. In continuation of our study on *Centaurea* species [9], we report here five flavonoid aglycones **1–5** from the endemic species *Centaurea sulphurea* Willd. [10].

The air-dried powdered aerial parts of *Centaurea sulphurea* (1 kg) were extracted in a Soxhlet apparatus with chloroform. The residue (7.5 g) was column chromatographed on silica gel (70–200 mesh) eluted with cyclohexane and dichloromethane (fractions 1–90), then with dichloromethane/ethyl acetate (fractions 91–130), and finally with ethyl acetate/methanol (fractions 131–166) with increasing polarity. Compounds **1–5** were found in fractions 1–90 and fractions 91–130. TLC purification on silica gel, eluted with dichloromethane–methanol (9:1), furnished compounds **1–5**, which were identified by UV, ^{1}H NMR, ^{13}C NMR, and MS analysis [11, 12], and all these data were in good agreement with the respective literature data [13–16].

Compound 1. $C_{18}H_{16}O_7$, oil. UV spectrum (MeOH, λ_{max}, nm): 280, 340; +NaOH: 280, 370; +$AlCl_3$: 280, 370; +$AlCl_3$/HCl: 280, 360; NaOAc: 277, 356. ^{1}H NMR (300 MHz, $CDCl_3$, δ, ppm, J/Hz): 7.51 (1H, dd, J_1 = 2, J_2 = 8, H-6′), 7.33 (1H, d, J = 2, H-2′), 6.98 (1H, d, J = 8, H-5′), 6.57 (1H, s, H-8), 6.56 (1H, s, H-3), 4.09 (3H, s, OCH_3), 3.99 (6H, s, 2 × OCH_3). Mass spectrum (CID/NH_3), *m/z*: 345 $[M + H]^+$. Characterized as 5,4′-dihydroxy-3′,6,7-trimethoxyflavone (cirsilineol).

Compound 2. $C_{17}H_{14}O_7$, yellow needles (EtOAc), mp 227–229°C. UV spectrum (MeOH, λ_{max}, nm): 274, 346; + $AlCl_3$/HCl: 259, 286, 364; +NaOH: 268, 320, 397; + NaOAc: 265; 275, 370. ^{1}H NMR (500 MHz, $CDCl_3$, δ, ppm, J/Hz): 4.00 (3H, s, OCH_3), 4.05 (3H, s, OCH_3), 6.50 (1H, s, H-8), 6.60 (1H, s, H-3), 7.02 (1H, d, J = 9, H-5′), 7.32 (1H, d, J= 2, H-2′), 7.47 (1H, dd, J = 2 and 9, H-6′). Mass spectrum (EI, 70 eV), *m/z*: 330 $[M]^+$. Characterized as 5,7,4′-trihydroxy-6,3′-dimethoxyflavone (jaceosidin).

Compound 3. $C_{19}H_{18}O_7$, mp 189–190°C. ^{1}H NMR (500 MHz, $CDCl_3$, δ, ppm, J/Hz), 3.92 (3H, s, OCH_3), 3.95 (3H, s, OCH_3), 3.97 (3H, s, OCH_3), 4.00 (3H, s, OCH_3), 6.58 (1H, s, H-8), 6.60 (1H, s, H-3), 6.98 (1H, d, J = 9, H-5′), 7.35 (1H, d, J = 2, H-2′), 7.53 (1H, dd, J = 2 and 9, H-6′). ^{13}C NMR (125 MHz, $CDCl_3$, δ): 56.1 (4′-OMe), 56.1 (3′-OMe), 58.5 (7-OMe), 61.0 (6-OMe), 91.0 (C-8), 104.5 (C-3), 105.5 (C-10), 111.0 (C-2′), 115.2 (C-5′), 120.1 (C-6′), 123.9 (C-1′), 133.0 (C-6), 149.5 (C-4′), 150.4 (C-3′), 151.8 (C-5), 153.2 (C-9), 155.1 (C-7), 163.0 (C-2), 182.5 (C-4). Mass spectrum (EI, 70 eV), *m/z*: 358 $[M]^+$. Characterized as 5-hydroxy-6,7,3′,4′-tetramethoxyflavone (3′-*O*-methyl-eupatorin).

Compound 4. $C_{16}H_{12}O_7$, yellow needles, mp 272°C. UV (MeOH, λ_{max}, nm): 352, 272; +NaOH: 272, 324, 404; +$AlCl_3$: 276, 424; +$AlCl_3$/HCl: 264, 280, 368; +NaOAc: 272, 352; +NaOAc/H_3BO_3: 264, 376. ^{1}H NMR (500 MHz, CD_3OD, δ, ppm, J/Hz): 3.98 (3H, s, OCH_3), 6.51 (1H, s, H-3), 6.52 (1H, s, H-8), 6.90 (1H, d, J = 9, H-5′), 7.36 (1H, d, J = 2, H-2′), 7.38 (1H, dd, J = 2 and 9, H-6′). ^{13}C NMR (125 MHz, $CDCl_3$, δ): 60.9 (OCH_3), 95.5 (C-8), 103.2 (C-3), 106.2 (C-10), 114.0 (C-2′), 116.6 (C-5′), 119.1 (C-6′), 124.2 (C-1′), 133.2 (C-6), 146.4 (C-3′), 149.4 (C-4′), 151.4 (C-5), 152.6 (C-9), 157.8 (C-7), 164.4 (C-2), 182.3 (C-4). Mass spectrum (EI, 70 eV), *m/z*: 316 $[M]^+$. Characterized as 5,7,3′,4′-tetrahydroxy-6-methoxyflavone (nepetin).

1) Laboratoire d′Obtention de Substances Therapeutiques (L.O.S.T), Faculte des Sciences, Universite Mentouri-Constantine, Campus Chaabat Ersas, 25000 Constantine, Algerie, fax: 213 31 81 88 59, e-mail: ahkabouche@yahoo.fr; 2) Universite Mohammed Premier Oujda, Faculte Pluridisciplinaire, Nador, Morocco; 3) Universite de Rennes 1, Campus de Beaulieu, 35042 Rennes cedex, France. Published in Khimiya Prirodnykh Soedinenii, No. 6, pp. 823–824, November–December, 2010. Original article submitted July 13, 2009.

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Compound 5. $C_{18}H_{16}O_7$, yellow crystals (EtOAc), mp 234–236°C. UV spectrum (MeOH, λ_{max}, nm): 339, 274; + $AlCl_3$/HCl: 361, 288, 258; + NaOH: 379, 320, 275; + NaOAc: 348, 276. ^{1}H NMR (500 MHz, $CDCl_3$, δ, ppm, J/Hz), 3.72 (3H, s, OCH_3), 3.75 (3H, s, OCH_3), 3.85 (3H, s, OCH_3), 6.56 (1H, s, H-8), 6.86 (1H, s, H-3), 7.03 (1H, d, J = 9, H-5′), 7.47 (1H, d, J = 2, H-2′), 7.58 (1H, dd, J = 2 and 9, H-6′). Mass spectrum (EI, 70 eV), *m/z*: 344 $[M]^+$. Characterized as 5,7-dihydroxy-6,3′,4′-trimethoxyflavone (eupatilin).

All the compounds are reported for the first time from the species.

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