FLAVONOIDS FROM *Thymus algeriensis*

R. Benkiniouar,[1] S. Rhouati,[1] A. Touil,[1] E. Seguin,[2] and E. Chosson[2]

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Thymus algeriensis (Boiss. et Reut.) is an aromatic species of the Labiatae family growing in North Africa (endemic species) known as "zhitra" [1]. In Algerian folk medicine the leaves and flowering branches are used as condiment, stomachic, diaphoretic, antispasmodic specifically for whooping cough, stimulant for the blood circulation, and aphrodisiac [2].

Previously isolated constituents were essential oil [3, 4] and the flavonoids: taxifolin, eriodictyol, 5,6-dihydroxy-7-3′,4′-trimethoxyflavone, and 5,6,4′-trihydroxy-7,3′-dimethoxyflavone [5].

Aerial parts of flowering *T. algeriensis* were collected from the Jijel region (eastern of Algeria) in June 1998. A voucher specimen has been deposited in the herbarium of the laboratory of natural substances and organic synthesis, University of Constantine under No. 05/ 1998/ L.T.A/03.

Dried powder of aerial parts (85 g) of flowering *T. algeriensis* was extracted with 70% MeOH solution, which was concentrated to dryness under reduced pressure. The residue (20 g) was dissolved in dist. H_2O (100 mL) stored in the cold and filtered after 24 hrs. The filtrate was extracted successively with EtOAc (2 g) and *n*-BuOH (8 g).

After PC (Whatman® N1) tests with 15% AcOH (system Ia), 30% AcOH (system Ib), and BAW (*n*-BuOH-AcOH–H_2O, 4 : 1 : 5 top layer (system II)), the EtOAc and *n*-BuOH extracts were combined (10 g) and subjected to CC on polyamide MN-SC6 eluted with a gradient of toluene-MeOH with increasing polarity; 54 fractions of 100 mL were collected and analyzed by cellulose TLC in the above systems in which similar fractions were combined to get only 12 fractions.

By preparative PC (Whatman® 3MM) using the above solvent systems some compounds were isolated. Purification of each compound for spectral analysis was carried out over a Sephadex LH-20 column eluted with MeOH. Three flavonoids are well identified by chromatography behavior, spectral data, and by co-chromatography with an authentic sample when possible and confirmed by comparison with literature data [6, 7]. Compound **1** was identified by spectroscopic techniques (UV-visible, ^{1}H NMR, ^{13}C NMR, DEPT, COSY, HMQC, and HMBC), while **2** and **3** were identified by UV-visible, ^{1}H NMR, and ^{13}C NMR spectra and acid hydrolysis [6].

Compound **1**. $C_{19}H_{18}O_7$; mp 188–191°C; R_f 0.25 (system Ib), 0.95 (system II)

UV (λ_{max}, nm), MeOH: 338, 276, 240sh; +NaOH: 385sh, 329, 286; +$AlCl_3$: 366, 287, 260; +HCl: 363, 260, 287; +NaOAc: 336, 277; +H_3BO_3: 337, 275. Mass spectrum (ES APCI), *m/z* (I_{rel}, %): 358 $[M]^+$ (10), 357 $[M-1]^+$ (45), 343 $[M-15]^+$ (100), 328 $[M-2\times15]^+$ (90), 313 $[M-3\times15]^+$ (92), 298 $[M-4\times15]^+$ (40).

^{1}H NMR (300 MHz, $CDCl_3$, δ, ppm, J/Hz): 12.68(1H, s, OH-5), 7.44 (1H, dd, J = 9, J = 2, H-6′), 7.25 (1H, d, J = 2, H-2′), 6.90 (1H, d, J = 9, H-5′), 6.51 (1H, d, J = 2, H-3), 6.47 (1H, s, H-8), 3.91(3H, s, OMe), 3.9(3H, s, OMe), 3.89(3H, s, OMe), 3.85(3H, s, OMe).

^{13}C NMR (75 MHz, $CDCl_3$): 183.68 (s, C-4), 165.04 (s, C-2), 159.82 (s, C-7), 154.28 (s, C-5), 154.11 (s, C-9), 153.36 (s, C-4′), 150.38 (s, C-3′), 133.68 (s, C-6), 124.79 (s, C-1′), 121.16 (d, C-6′), 112.21 (d, C-5′), 109.78 (d, C-2′), 107.19 (s, C-10), 105.48 (d, C-3), 91.68 (d, C-8), 61.95 (q, 6-OMe), 57.44 (q, 7-OMe), 57.21(q, 4′-OMe, 3′-OMe).

Compound **1** is identified as 5-hydroxy-6,7,3′,4′-tetramethoxyflavone (5-desmethylsinensetin).

Compound **2**. $C_{27}H_{30}O_{16}$; mp 250–254°C; R_f 0.61 (system Ia), 0.22 (system II).

UV (λ_{max}, nm), MeOH: 356, 300sh, 265sh, 257; +NaOH: 407, 325, 272; + $AlCl_3$: 423, 350sh, 290sh, 275; +HCl: 390, 350, 285sh, 268; +NaOAc: 385, 271; +H_3BO_3: 378, 263.

1) Departement de chimie, Faculte des sciences, Universite Mentouri de Constantine, Route Ain El-Bey, 25000, Constantine, Algerie, tel/fax: 213 31 81 88 62, e-mail: benkiniouarrachid@yahoo.fr; 2) Laboratoire de pharmacognosie UFR de medecine et pharmacie, Rouen, France. Published in Khimiya Prirodnykh Soedinenii, No. 3, pp. 267-268, May-June, 2007. Original article submitted March 15, 2006.

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^{1}H NMR (250 MHz, CD_3OD, δ, ppm, J/Hz): 7.80 (1H, d, J = 2, H-2′), 7.75 (1H, dd, J = 9, J = 2, H-6′), 6.85 (1H, d, J = 9, H-5′), 6.3 (1H, d, J = 2, H-8), 6.20 (1H, d, J = 2, H-6), 5.12 (1H, d, J = 7, H-1″ glucose), 4.55 (1H, d, br.s, H-1‴rhamnose), 1.1 (3H, d, J = 6.2, H-6‴rhamnose), 3.20 – 3.90 (10H, protons of rutinose).

^{13}C-NMR (62.89 MHz, CD_3OD): 177.96 (C-4), 164.61(C-7), 161.55(C-5), 157.89(C-2),157.06(C-9), 148.39(C-4′), 144.41(C-3′), 134.18(C-3), 122.11(C-6′), 121.64(C-1′), 116.24(C-5′), 114.61 (C-2′), 104.17(C-10), 103.29(C-1″), 100.97(C-1‴), 98.51(C-6), 93.41(C-8), 76.72(C-5″), 75.76(C-3″), 74.27(C-2″), 72.47(C-4‴), 70.77(C-4″), 70.65(C-2″), 69.91(C-3‴), 68.27(C-5‴), 67.10(C-6″), 16.47 (C-6‴). Identified as quercetin-3-*O*-rutinoside.

Compound **3**. $C_{21}H_{20}O_{10}$; R_f 0.25 (system Ia), 0.45 (system II).

UV (λ_{max}, nm) MeOH: 349, 266sh, 255; +NaOH: 397, 285sh, 266; +$AlCl_3$: 421, 290sh, 272; +HCl: 390, 350, 290sh, 269; +NaOAc: 353, 258; +H_3BO_3: 374, 285sh, 259.

^{1}H NMR (300 MHz,CD_3OD, δ, ppm, J/Hz): 7.32 (1H, dd, J = 9, J = 2, H-6′), 7.31 (1H, d, J = 2, H-2′), 6.83 (1H, d, J = 9, H-5′), 6.66 (1H, d, J = 2, H-8), 6.52 (1H, s, H-3), 6.42 (1H, d, J = 2, H-6), 5.29 (1H, d, J = 2, H-1″rhamnose), 3.33 – 4.00(4H, rhamnose), 1.08 (3H, d, J = 6.5, H-6″ rhamnose). Compound **3** is identified as luteolin-7-*O*-rhamnoside.

To the best of our knowledge, all these compounds are isolated from *T. algeriensis* for the first time, compound **1** was isolated from others species of *Thymus* [8–10] while compounds **2**, **3** are identified in *Thymus* genera for the first time.

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