

7-Hydroxy-4-methoxy-5-methylcoumarin: A Further 5-Methylcoumarin from *Toona ciliata* (Meliaceae)

Rasheduzzaman Chowdhury^{1*}, Aliza Ahmed², and Md. Zakiur Rahman²

¹Phytochemical Research Laboratory, Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Dhaka, Dhaka-1000, Bangladesh

²Phytochemistry Research Laboratory, Department of Pharmacy, The University of Asia Pacific, Dhanmondi R/A, Dhaka-1209, Bangladesh

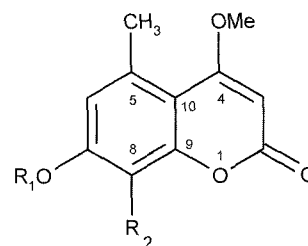
Abstract – A 5-C-methylcoumarin was isolated from the petroleum ether extract of *Toona ciliata* stem bark. Its structure was established as 7-Hydroxy-4-methoxy-5-methylcoumarin on the basis of spectral data, including 2D NMR.

Keywords – *Toona ciliata*, 7-Hydroxy-4-methoxy-5-methylcoumarin, Chemotaxonomy

Toona ciliata M. J. Roem. is a tall deciduous tree widely distributed in south and southeast Asia. As part of our systematic study of Meliaceae species, we have recently reported three chemotaxonomically interesting 5-C-methylcoumarins (**1-3**) and a new hydroxy steroidal ketone from the Bangladeshi cedar^{1,2}. The taxonomic relationship between the genera, *Toona* and *Cedrela* in respect to methylcoumarin-accumulation has also been illustrated to date¹. This paper details the isolation and structure elucidation of one further 5-C-methylcoumarin (**4**) from the same plant. The compound was identified by means of comprehensive analysis of NMR spectra.

Normal phase column and preparative thin layer chromatography of a petroleum ether extract yielded compound **4**, as colorless needles (0.0066% yield). The ¹H NMR spectrum of **4** readily indicated an oxygenated 5-C-methylcoumarin³: two 3H singlets at δ 2.60 and 3.98, two aromatic broad singlets at δ 6.56 and 6.60 (each 1H) and an olefinic 1H singlet at δ 5.59. Comparing with **1-3**, the methyl singlet at δ 2.60 must be ascribed to C-5 of ring A, while the remaining 3H singlet (δ 3.98) to C-4/C-7 as a methoxy group. The deshielded nature of the methoxyl protons could be better explained at C-4 on account of the magnetic anisotropy of C-2 carbonyl functionality. Furthermore, the ³J correlation of the methoxyl protons to C-3 restricted its attachment to C-4 of the pyrone ring. The two aromatic proton signals at δ 6.56 and 6.60 must be *meta*-related, both vicinal to the hydroxyl and were attributed to H-6 and H-8 on the basis of their HMBC connectivities. The other olefinic 1H singlet

at δ 5.58 was assigned to H-3 of the heterocycle, in view of the relatively small chemical shift of its ¹H NMR signal. Unambiguous C-H correlations, obtained by HSQC and HMBC experiments, identified the compound as 7-hydroxy-4-methoxy-5-methylcoumarin. In previous studies, identification of this compound had been based primarily on ¹H NMR spectral data interpretation, elementary, mass spectral, and functional analysis³. We therefore, report in full for the first time, the ¹³C NMR data, which were in good agreement with reported values for structurally related, siderin (**1**)⁴.



- 1:** R₁ = Me; R₂ = H
2: R₁ = Me; R₂ = OMe
3: R₁ = H; R₂ = OMe
4: R₁ = H; R₂ = H

As discussed earlier, the restricted occurrence of 5-C-methylcoumarins among the two genera, *Toona* and *Cedrela* (Meliaceae - Cedreleae) renders them valuable as taxonomic information¹. The isolation of 7-hydroxy-4-methoxy-5-methylcoumarin (**4**) strengthens the likelihood that the two genera are closely allied and supports their placement in the same tribe Cedreleae.

The ¹H- (400 MHz) and ¹³C- (100 MHz) NMR spectra were obtained in CD₃OD on a Bruker DPX 400 spectrometer

*Author for correspondence

Fax: +880-2-8615583; E-mail: rzchy@dhaka.net

and the chemical shifts are reported in ppm relative to the residual nondeuterated solvents. Assignments of and heteronuclear correlation between NMR signals were achieved using standard Bruker microprograms: HSQC and HMBC (with delay set for 2J , 3J of ca. 7 Hz). Si gel 60 (70-230 mesh, ASTM) was used for CC; TLC was carried out on 20×20 cm Kieselgel PF₂₅₄ plates (Merck), and the spots were visualized under UV (254 and 366 nm), and by spraying the plates with vanillin (1%)-H₂SO₄ (10%) in EtOH, followed by heating.

Stem bark of *T. ciliata* was collected from the Comilla district of Bangladesh in August 2000 and the plant was identified at the Bangladesh National Herbarium where a voucher specimen has been deposited (DACB accession no. 28,926). Soxhlet-extraction of the air-dried and powdered stem bark (150.0 g) with 0.5 L of light petroleum ether (40°-60°) yielded 1.5 g of petrol extract. Normal phase column chromatography of 1.2 g of the petrol extract yielded a total of 56 fractions (each ca. 30 mL) by eluting the column with petroleum ether, petroleum ether-EtOAc, EtOAc and EtOAc-MeOH mixtures of increasing polarity. Following preparative TLC of column fractions 36 to 41 using toluene EtOAc-acetic acid (80:20:1) as developing solvent afforded

7.9 mg of **4**.

7-Hydroxy-4-methoxy-5-methylcoumarin (**4**): white crystal; ${}^1\text{H}$ NMR (400 MHz, CD₃OD): δ 2.60 (3H, s, Me-5), 3.98 (3H, s, OMe-4), 5.59 (1H, s, H-3), 6.56 (1H, s, H-8), 6.60 (1H, s, H-6); ${}^{13}\text{C}$ NMR (100 MHz, CD₃OD): δ 17.0 (Me-5), 58.3 (OMe-4), 78.9 (C-3), 101.7 (C-8), 113.6 (C-6), 115.4 (C-10), 133.9 (C-5), 146.8 (C-9), 158.2 (C-7), 163.0 (C-2), 172.0 (C-4).

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