

## TRITERPENES FROM *CELASTRUS HINDSII* BENTH.

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TRINH THI THUY, NGUYEN HUY CUONG, TRAN VAN SUNG  
Institute of Chemistry, Vietnamese Academy of Science and Technology

### SUMMARY

Chemical investigation of the leaves of *Celastrus hindsii* growing in Quang Binh, Vietnam led to the isolation and structural elucidation of three triterpenes, 3-friedelanol, 3-friedelanone and canophyllol. These structures were determined on the basis of MS and NMR spectroscopic data.

**Keywords:** *Celastrus hindsii*, *celastraceae*, *friedelanol*, *friedelanone*, *canophyllol*.

### I - INTRODUCTION

The Celastraceae constitutes approximately 88 genera and over 1300 species of plants and are widely distributed throughout South America, China and Vietnam [1]. They have been chemically intensive studied due to many biological activities. Plant extracts of the Celastraceae have been used for centuries as insect repellents and insecticides in traditional agriculture and also for the treatment of stomach disease and cancer [1, 2]. *Celastrus hindsii* Benth. is a small trees growing wild or cultivated in Son La, Hoa Binh, Quang Ninh, Nam Ha, Quang Binh provinces of Vietnam. The EtOH extract of the stems from *C. hindsii* shows potent cytotoxicity against hepatoma, cervix carcinoma, and colon carcinoma and nasopharynx carcinoma cells as well as against HIV replication activity in H-9 lymphocytes *in vitro* [2]. The crude extract of *C. hindsii* under the local name "Xa den" is used successfully as antitumor, anticancer agents in the Army Hospital (QY 108 Hospital, Dr. Le The Trung). Phytochemical investigation of *C. hindsii* was reported to contain triterpenes, sesquiterpene pyridine alkaloids as its main components [2, 3]. In our search for biological active compounds from *Celastrus* genus, we now report the

isolation and structural determination of 3-friedelanol (**1**), 3-friedelanone (**2**) and canophyllol (**3**). These structures were elucidated by MS and NMR methods.

### II - EXPERIMENTAL

#### 1. General

Optical rotation  $[\alpha]_D$ : Digital Polarimeter Jasco DIP 1000. EIMS: ADM 402, 70 eV, Finnigan TSQ 700. HR-ESI-MS: BRUKER BIOAPEX 70e Fourier transforms. NMR: BRUKER Avance 500 spectrometer at 499.8 MHz ( $^1\text{H}$ ) and 125 MHz ( $^{13}\text{C}$ ,  $^{13}\text{C}$  DEPT). Chemical shifts were referenced to internal TMS ( $\delta = 0$ ,  $^1\text{H}$ ) and  $\text{CDCl}_3$  ( $\delta = 77.0$ ,  $^{13}\text{C}$ ). CC: Silica gel 60, 0.06 - 0.20 mm (Merck) for the first column, silica gel 60, 40 - 63  $\mu\text{m}$  (Merck) for the following columns. TLC: Silica gel 60 F-254 (Merck).

#### 2. Plant material

The leaves of *C. hindsii* were collected in Quang Binh, Vietnam, in October 2005. The species was identified by Mr. Nguyen Quoc Binh, Institute of Ecology and Natural Resources, VAST, Hanoi, Vietnam. A voucher

specimen is deposited in the Herbarium of this Institute.

### 3. Extraction and isolation

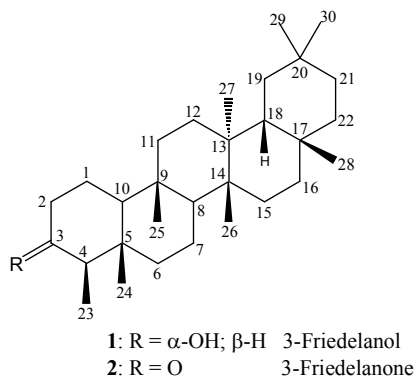
The dried and powdered leaves of *C. hindsii* (600 g) were extracted with 90% aq. EtOH at room temperature. EtOH was evaporated *in vacuo* at 45°C and the aq. solution was partitioned with *n*-hexane followed by EtOAc and *n*-BuOH. The organic solvents were evaporated *in vacuo* to afford 25.5; 2.5; 15 g of *n*-hexane, EtOAc and *n*-BuOH extracts, respectively. The *n*-hexane extract (25 g) was chromatographed over silica gel with gradient *n*-hexane-EtOAc (90:10 → 10:90) to give 6 fractions (F-1 → F-6).

#### a) 3-Friedelanol (**1**)

Compound **1** was purified from fraction 3 by silica gel CC with *n*-hexane-EtOAc (80:20), white powder from MeOH, yield 0.0027%; ESI-MS: 411 [M+H-H<sub>2</sub>O]<sup>+</sup> (100), 397 [M+H-H<sub>2</sub>O-14]; IR  $\nu_{\max}^{KBr}$  (cm<sup>-1</sup>): 3478 (OH), 2934, 2884, 1703 (C=O), 1451, 1385, 1177. <sup>1</sup>H-NMR (500 MHz, CDCl<sub>3</sub>):  $\delta$ 0.86 (s, Me-24), 0.94 (3H, s, Me-30), 0.95 (d, J = 7.8 Hz, H-23), 1.00 (3H, s, Me-26), 1.01 (3H, s, Me-27), 1.05 (3H, s, Me-29), 1.17 (3H, s, Me-28), 1.88 (1H, m, H-1a), 1.73 (1H, m, H-2b, H-4). <sup>13</sup>C-NMR data, see table 1.

#### b) 3-Friedelanone (friedelin, **2**)

3-Friedelanone was isolated from fractions 1 and 2, yield 0.0023%. Powder from MeOH/EtOAc; ESI-MS (*m/z*): 427



[M+H]<sup>+</sup>(100), 409 [M-H<sub>2</sub>O]<sup>+</sup> (28), 397 [M+H-30]<sup>+</sup>; <sup>1</sup>H-NMR (500 MHz, CDCl<sub>3</sub>):  $\delta$ 0.74 (s, Me-24), 0.87 (d, J = 7.8 Hz, H-23), 0.95 (3H, s, Me-30), 1.00 (3H, s, Me-26), 1.01 (3H, s, Me-27), 1.05 (3H, s, Me-29), 1.18 (3H, s, Me-28), 1.96 (1H, m, H-1a), 2.28 (2H, m, H-2b, H-4), 2.39 (1H, ddd, J = 14, 5, 2 Hz). <sup>13</sup>C-NMR data, see table 1.

#### c) Canophyllol (28-hydroxy-3-friedelanone, **3**)

The crude compound **3** was isolated from fraction 6 and further purified by chromatography on sephadex LH-20 (MeOH) and then silica gel with EtOAc-MeOH (60:10); powder from MeOH-EtOAc; IR  $\nu_{\max}^{KBr}$  (cm<sup>-1</sup>): 3542 (OH), 2934, 2877, 1705 (C=O), 1462, 1389, 1055; ESI-MS (*m/z*): 442 [M+H]<sup>+</sup> (57), 425 [M+H-H<sub>2</sub>O]<sup>+</sup> (100). <sup>1</sup>H-NMR (500 MHz, CDCl<sub>3</sub>):  $\delta$ 0.72 (s, Me-24), 0.87 (d, J = 7.8 Hz, H-23), 0.91 (3H, s, Me-30), 0.98 (3H, s, Me-26), 0.99 (3H, s, Me-27), 1.13 (3H, s, Me-29), 1.56 (3H, s, Me-28), 1.96 (1H, m, H-1a), 2.27 (2H, m, H-2b, H-4), 2.40 (1H, ddd, J = 14, 5, 2 Hz), 3.63 (1H, br d, J = 3.2 Hz, H-3 $\beta$ ). <sup>13</sup>C-NMR data, see table 1.

## III - RESULTS AND DISCUSSION

The residue of an ethanol extract of the leaves of *C. hindsii* was partitioned with *n*-hexane, ethyl acetate and *n*-butanol, successively. The *n*-hexane extract, after evaporation of the solvents, was subjected to column chromatography, recrystallization to give three triterpenes **1 - 3**.

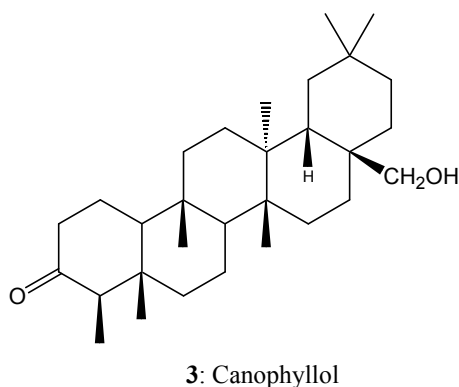


Table 1:  $^{13}\text{C}$ -NMR spectral data of triterpenes **1** - **3** [125 MHz,  $\text{CDCl}_3$ ,  $\delta$  (ppm)]

C	<b>1</b>	<b>2</b>	<b>3</b>
1	18.66	22.29	22.70
2	39.30	41.53	41.51
3	72.78	213.18	213.13
4	53.22	58.24	58.23
5	39.70	42.15	42.11
6	41.75	41.31	41.25
7	17.57	18.25	18.25
8	49.20	53.12	52.50
9	37.85	37.46	37.47
10	61.38	59.50	59.49
11	32.84	35.64	34.51
12	30.66	30.52	28.15
13	38.39	39.71	38.16
14	37.13	38.32	37.47
15	30.66	32.80	29.14
16	32.36	36.03	31.26
17	37.86	30.01	35.17
18	42.85	42.82	39.38
19	32.84	35.36	33.38
20	30.04	28.17	30.10
21	32.35	32.44	31.41
22	41.75	39.26	41.51
23	11.63	6.82	6.82
24	16.41	14.66	14.67
25	20.13	17.95	19.20
26	18.66	20.26	19.08
27	18.26	18.66	18.08
28	31.81	32.10	68.04
29	30.04	31.79	34.26
30	32.10	35.03	32.85

The ESI-MS of compound **1** gave a peak at  $m/z$  411  $[\text{M}+\text{H}-\text{H}_2\text{O}]^+$  (100%), corresponding to the molecular formula  $\text{C}_{30}\text{H}_{52}\text{O}$ . The IR

spectrum indicated a hydroxyl ( $3478\text{ cm}^{-1}$ ), a ketone ( $1703\text{ cm}^{-1}$ ) group. The  $^{13}\text{C}$ -NMR and DEPT spectra showed the presence of signals for 30 carbons including  $\text{CH}_3 \times 8$ ,  $\text{CH}_2 \times 11$ ,  $\text{CH} \times 5$ ,  $\text{Cq} \times 6$ , suggested that **1** is a friedelin triterpene skeleton. This was further confirmed by the signals of one secondary, 7 tertiary methyl groups in the  $^1\text{H}$ -NMR spectrum. The structure of **1** was identified as 3-friedelanol by comparison of the  $^1\text{H}$ - and  $^{13}\text{C}$ -NMR spectra with the reported data [4]. This compound was frequently found in the plants (*Quercus* spp. and *Euphorbia* spp, ...) [4, 5].

Compound **2** was obtained as white needles from the *n*-hexane extract using column chromatography on silica gel. The ESI-MS spectrum gave a peak at  $m/z$  427  $[\text{M}+\text{H}]^+$ , corresponding to the molecular formula  $\text{C}_{30}\text{H}_{50}\text{O}$ , and have two protons less than **1**. The  $^1\text{H}$ - and  $^{13}\text{C}$ -NMR spectral data of **2** were similar to those of **1**, except the changes due to the presence of a carbonyl group ( $\delta_{\text{C}}$  213.2). Compound **2** was identified as 3-friedelanone from its identical  $^1\text{H}$ - and  $^{13}\text{C}$ -NMR spectra with the reported data [4].

Compound **3** was obtained as white needles. Its IR spectrum showed bands for carbonyl ( $1705\text{ cm}^{-1}$ ) and hydroxyl ( $3542\text{ cm}^{-1}$ ) group.

The molecular formula of **3** was established as  $\text{C}_{30}\text{H}_{50}\text{O}_2$  by combination of  $^{13}\text{C}$ -NMR and the peak at  $m/z$  442  $[\text{M} + \text{H}]^+$  (58), with one O-atom more than **2**. The  $^1\text{H}$ - and  $^{13}\text{C}$ -NMR spectral data of **3** were very similar to those of **2**, except the changes due to the presence of methylenoxy group ( $\delta_{\text{H}}$  3.64,  $\delta_{\text{C}}$  68.04). The position of hydroxyl group at C-28 was determined by comparison of its  $^1\text{H}$ -,  $^{13}\text{C}$ -NMR spectral data with those of **1** and **2**. The  $^{13}\text{C}$ -NMR spectra indicated the presence of a carbonyl group ( $\delta_{\text{C}}$  213.13). In comparison with literatures [4, 5], the structure of **3** was determined as 28-hydroxy-3-friedelanone (canophyllol). This compound was isolated for the first time from *Calophyllum inophyllum*, and shows antimicrobial activity.

This is the first time triterpenes **1** - **3** were isolated from *C. hindsii* [4].

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