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POLAR EUPOMATENOIDS FROM *CARYODAPHNOSIS TONKINENSIS*

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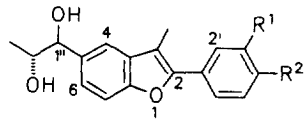
Key Word Index—*Caryodaphnosis tonkinensis*; Lauraceae; bark; neolignans; benzofurans.

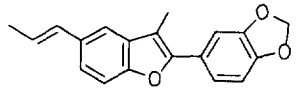
Abstract—From the bark of *Caryodaphnosis tonkinensis* three new polar eupomatenoids were isolated, for which the structures 5-(*erythro*-1,2-dihydroxypropyl)-2-(4-hydroxyphenyl)-3-methylbenzo[*b*]furan, 5-(*erythro*-1,2-dihydroxypropyl)-3-methyl-2-(3,4-methylenedioxyphenyl)benzo[*b*]furan and 5-(*erythro*-1,2-dihydroxypropyl)-2-(4-hydroxy-3-methoxyphenyl)-3-methylbenzo[*b*]furan were determined by spectral methods.

INTRODUCTION

The tree *Caryodaphnosis tonkinensis* (Lec.) A.-Shaw (which grows up to a height of 40 m) is an endemic plant of Vietnam. Recently, we isolated the eupomatenoids 3–6 and 13 from the bark of this species [1]. The present study showed that with methanol more polar eupomatenoids could be extracted, for which the structures 5-(*erythro*-1,2-dihydroxypropyl)-2-(4-hydroxyphenyl)-3-methylbenzo[*b*]furan (**1**), 5-(*erythro*-1,2-dihydroxypropyl)-3-methyl-2-(3,4-methylenedioxyphenyl)benzo[*b*]furan (**2**) and 5-(*erythro*-1,2-dihydroxypropyl)-2-(4-hydroxy-3-methoxyphenyl)-3-methylbenzo[*b*]furan (**3**) have been elucidated as outlined below.



1 R^1 = H, R^2 = OH
2 R^1 + R^2 = OCH_2O
3 R^1 = OMe, R^2 = OH



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RESULTS AND DISCUSSION

The elemental compositions of **1–3** were shown to be $C_{18}H_{18}O_4$, $C_{19}H_{18}O_5$ and $C_{19}H_{20}O_5$, respectively, by high resolution mass spectrometry. Furthermore, the ion $[M - MeCHOH]^+$ was the base peak in each case. The strong UV absorption was in agreement with aromatic structures. The ^1H and ^{13}C NMR spectra of **1–3** were assigned by comparison with those of the eupomatenoids 6, 3 (**4**) and 5 [1] (Tables 1 and 2). 2D HMQC spectra were used to correlate the ^1H and ^{13}C shifts. The proton–proton coupling networks were analysed by the H,H-COSY-90 technique. The 1D NOE difference spectra of **3** indicated the proximity of the methoxy protons with H-2′. Comparison of the ^1H and ^{13}C NMR spectra (Tables 1 and 2) with those of eupomatenoids [1] secured the common 2-aryl-3-methylbenzo[*b*]furan structure, but with a propan-1,2-diol side chain at position 5, and revealed the substitution pattern of the aryl groups. Eupomatenoid 3 [1, 2] (**4**) with (*E*)-configuration was transformed to racemic **2** on treatment with *m*-chloroperbenzoic acid followed by alkaline hydrolysis according to ref. [3], proving the relative configuration to be *erythro*. Racemic and enantiomeric **2** had identical ^1H and ^{13}C NMR spectra. A compound (named eupomatenoid 9) with the constitution of **3** had already been isolated from *Eupomatia laurina* R. Br. [3]. As the optical rotation was not reported, it cannot be excluded that it was the antipode of our product.

We tried to determine the absolute configurations of the compounds **1–3** by reaction with $Mo_2(OAc)_4$ at room temp. or 50° (30 min) and circular dichroism measurements [4–6]. Unexpectedly, no CD was detected between 250 and 500 nm. The reason seems to be that the *erythro* configurations of **1–3** allow two stable conformations of the 1,2-diol ligands with opposite signs of the torsional angles of the O–C–C–O bond systems in the complexes causing opposite signs of the CD.

EXPERIMENTAL

Caryodaphnosis tonkinensis was collected in the National Park Cuc Phuong, Province of Ninh Binh, Viet-

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Table 1. ^{1}H NMR of compounds **1** (CD_3OD), **2** ($CDCl_3$) and **3** (CD_3OD + $CDCl_3$) [TMS, 499.84 MHz, coupling constants J (Hz) in parentheses]

H	1	2	3
4	7.52 *d* (1.7)	7.41 *d* (1.8)	7.57 *d* (1.2)
6	7.25 *dd* (8.5, 1.7)	7.15 *dd* (8.5, 1.8)	7.24 *dd* (8.4, 1.2)
7	7.38 *d* (8.5)	7.34 *d* (8.5)	7.41 *d* (8.4)
2′	7.63 *d* (8.6)	7.22 *d* (1.8)	7.34 *d* (1.4)
5′	6.90 *d* (8.6)	6.84 *d* (7.8)	6.95 *d* (8.3)
6′	7.63 *d* (8.6)	7.19 *dd* (7.8, 1.8)	7.26 *dd* (8.3, 1.4)
1″	4.45 *d* (7.3)	4.41 *d* (7.6)	4.44 *d* (7.6)
2″	3.87 *m*	3.87 *m*	3.89 *m*
3″	0.97 *d* (6.4)	1.00 *d* (6.4)	1.01 *d* (6.1)
3-Me	2.42 *s*	2.35 *s*	2.45 *s*
R^1	—	5.94 *s*	3.97 *s*
R^2	—	—	—

Table 2. ^{13}C NMR of compounds **1** (CD_3OD), **2** ($CDCl_3$) and **3** (CD_3OD + $CDCl_3$) (TMS, 125.70 MHz)

C	1	2	3
2	153.0	151.3	151.2
3	110.1	110.1	109.6
3a	132.5	131.4	130.9
4	118.5	117.4	116.9
5	134.1	135.3	135.2
6	124.1	123.0	122.5
7	111.1	110.7	109.8
7a	154.7	153.3	152.8
1′	124.1	125.3	122.8
2′	129.2	107.2	109.0
3′	116.6	147.9	147.2
4′	158.9	147.4	146.0
5′	116.6	108.6	114.8
6′	129.2	121.0	119.7
1″	80.6	79.8	79.2
2″	73.2	72.6	71.8
3″	19.4	18.9	18.1
3-Me	9.4	9.5	8.6
R^1	—	101.3	55.2
R^2	—		—

nam, in January 1993. The species was identified by Dr Tran Dinh Dai, Hanoi. A voucher specimen is deposited in the Herbarium of the Institute of Ecology and Natural Resources of the National Centre for Scientific Research, Hanoi. The dried bark (at 40°) was extracted with petrol followed by MeOH at room temp. Evapn of the MeOH *in vacuo* gave a residue which was partitioned between H_2O and $CHCl_3$–EtOH (2:1). Evapn of the organic solvents *in vacuo* gave an extract which was chromatographed over Merck silica gel 60 (0.040–0.063 mm) with $CHCl_3$–MeOH (39:1) (**2**, **3**) followed by $CHCl_3$–MeOH (19:1) (**1**) or with EtOAc–*n*-hexane (7:3) (**2**, **3**). The compounds were further purified by prep. TLC using Merck PLC plates silica gel 60 F_{254} (layer thickness 1 mm) and $CHCl_3$–MeOH (9:1) (**1**–**3**). For analytical purposes Merck TLC aluminium sheets silica gel 60 F_{254} (layer thickness 0.2 mm) were used.

5-(erythro-1,2-*dihydroxypropyl*)-2-(4-*hydroxyphenyl*)-3-*Methylbenzo*[b]*furan* (**1**). From $CHCl_3$–MeOH crystals, yield 0.003%, mp 162–166°. $[\alpha]_D^{25}$ + 15.8° (MeOH; *c* 0.75). R_f 0.42 [$CHCl_3$–MeOH (9:1)]. UV λ_{max}^{MeOH} nm (log ε): 308 (4.28); EIMS (70 eV) *m/z* (rel. int.): 298.1213 $[M]^+$ ($C_{18}H_{18}O_4$, calcd 298.1221) (44), 253.0896 $[M - MeCHOH]^+$ ($C_{16}H_{13}O_3$, calcd 253.0928) (100).

5-(erythro-1,2-*dihydroxypropyl*)-3-*Methyl*-2-(3,4-*methylenedioxyphenyl*)*benzo*[b]*furan* (**2**). Amorphous, yield 0.003%. $[\alpha]_D^{25}$ + 12.0° ($CHCl_3$; *c* 0.73). R_f 0.69 [$CHCl_3$–MeOH (9:1)]. UV λ_{max}^{MeOH} nm (log ε): 315 (4.13); EIMS (70 eV) *m/z* (rel. int.): 326.1160 $[M]^+$ ($C_{19}H_{18}O_5$, calcd 326.1165) (77), 281. 0795 $[M - MeCHOH]^+$ ($C_{17}H_{13}O_4$, calcd 281.0776) (100).

5-(erythro-1,2-*dihydroxypropyl*)-2-(4-*hydroxy*-3-*methoxyphenyl*)-3-*Methylbenzo*[b]*furan* (**3**). From $CHCl_3$–MeOH crystals, yield 0.006%, mp 169–171°, ref. [3] 165–168°. $[\alpha]_D^{25}$ + 11.2° (MeOH; *c* 0.65). R_f 0.53 [$CHCl_3$–MeOH (9:1)]. UV λ_{max}^{MeOH} nm (log ε): 312 (4.12); EIMS (70 eV) *m/z* (rel. int.): 328.1373 $[M]^+$ ($C_{19}H_{20}O_5$, calcd 328.1435) (54), 283.0953 $[M - MeCHOH]^+$ ($C_{17}H_{15}O_4$, calcd 283.0936) (100).

Conversion of eupomatenoid 3 (**4**) *into* (±)-5-(erythro-1,2-*dihydroxypropyl*)-3-*methyl*-2-(3,4-*methylenedioxyphenyl*)*benzo*[b]*furan* (*rac.* **2**). According to ref. [3], 38 mg of **4** was reacted with 25 mg *m*-chloroperbenzoic acid in 1 ml CH_2Cl_2 for 18 hr at room temp. Excess peracid was destroyed by addition of 10% aq. Na_2SO_3. The organic layer was washed with 5% aq. $NaHCO_3$, dried, the solvent evaporated *in vacuo* and the residue chromatographed on silica gel with *n*-hexane–EtOAc (9:1). During the course of the chromatography a part of the substance (one main spot in TLC) was converted to a second compound (mixture *ca* 1:1, probably acyl migration), but both compounds furnished the same diol on hydrolysis with 10% K_2CO_3 in MeOH (reflux, 30 min), yield 22 mg (51%), identical ^{1}H as well as ^{13}C NMR spectra to those of **2**.

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