

5'-METHOXYYYATEIN AND 5'-METHOXYPODORHIZOL
 NEW LIGNANS ISOLATED FROM HERNANDIA CORDIGERA VIELL.¹

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Abstract - Two new dibenzylbutyrolactone lignans have been isolated from Hernandia cordigera: 5'-methoxyyyatein and 5'-methoxypodorhizol. Their structures have been determined by means of high resolution ¹H nmr spectra, CD curves and acidic cyclization.

Leaves and barks of Hernandia cordigera (Hernandiaceae) are rich in lignans.² The main compound has been found to be desoxypodophyllotoxin 1. We wish now to report two new dibenzylbutanolides: the 5'-methoxyyyatein 2 and the 5'-methoxypodorhizol 5.

The lignans were isolated using the method reported in our precedent publication¹. 2 and 5 were obtained pure by TLC.

The 5'-methoxyyyatein 2, C₂₃H₂₆O₈, α_D: -21° (CHCl₃, c=1), was obtained as an amorphous powder. Its ir spectrum shows the presence of a lactone (ν 1760 cm⁻¹).

The ¹H nmr spectrum indicates a substitution by four aromatic methoxyl groups (δ 3.82, 3.83 (6H) and 3.85 ppm). These data and the fragmentation as obtained in the mass spectrum (m/z 181 and 165) are characteristic of a butenolide substituted in C-2 and C-3 by a trimethoxybenzyl group and a methoxy-methylenedioxybenzyl group.³ The major ion at m/z 181, resulting from a cleavage of the C-2 - C-6 bond and the ions at m/z 191 and 238 supplied a clear cut answer to the substitution pattern of 2, which is the 2-(3",4",5"-trimethoxybenzyl)-butyrolactone.^{4,5}

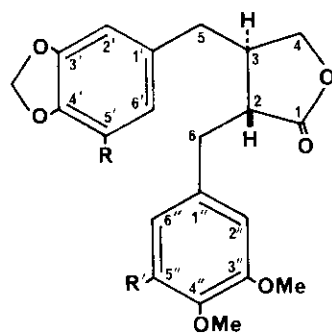
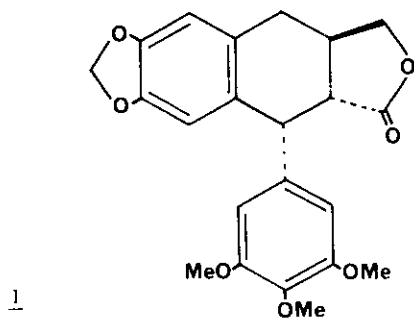
The relative configuration in C-2 and C-3 can be established by a further study of the ¹H nmr spectrum. The coupling constants J_{3-4a} and J_{3-4b} are almost equiva-

lent (7.0 Hz and 7.2 Hz respectively), which indicates that a trans relationship prevails between the two benzylic groups.⁵ The different chemical shifts for H-4a (δ 3.87 ppm) and for H-4b (4.18 ppm) and the equivalence of the protons in C-6 and C-5 confirm the 2-3 trans configuration.^{6,7} 2 has the 2R,3R configuration since its CD curve is similar to that of yatein 3 and of bursehenin 4,^{8,9,10} whose ¹H nmr and ¹³C nmr spectra are also closely related to this of 2 (Tab. 1).

The second lignan isolated 5 shows spectral data which point to a close relationship with compound 2.⁷ The ir spectrum displays, besides the absorption due to the lactone, a band at ν 3435 cm⁻¹ characteristic for a hydroxyl group. The ¹H nmr spectrum indicates the same substitution pattern on the two benzylic groups as in lignan 2. The mass spectrum shows a molecular ion at m/z 446 (C₂₃H₂₆O₉) meaning that 5 contains one oxygen more than 2. The base peak is at m/z 197, corresponding to the ion a instead of 181 as in the mass spectrum of 2; therefore, the hydroxyl group must be in the C-6 position. The aliphatic region in the ¹H nmr spectrum is also in favor of a 2-3 trans configuration; it was confirmed by the fact that in an NOE difference study of the compound 5 no NOE effect was observed between H-2 and H-3. The lignan 5 is a 5'-methoxypodorhizol. Indeed an acidic cyclization of 5 led to the formation of aryltetrahydronaphthalenes which are identified as hernandin and microhernandin.¹¹ However, the formation of a 1-X aryltetrahydronaphthalene by cyclization and the elimination of the absorption at ν 3435 cm⁻¹ in the ir spectrum by dilution is in favor of 6S configuration.

Table 1 : ¹³C nmr spectra (CDCl₃, ppm)

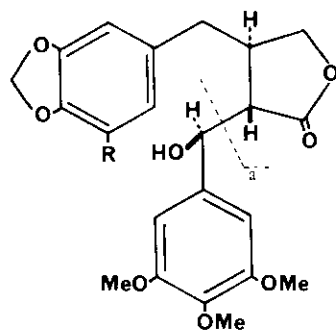
| | C-1 | C-2 | C-3 | C-4 | C-5 | C-6 | C-1' | C-2' | C-3' | C-4' | C-5' | C-6' |
|----------|-------|--------|-------|-------|-------|--------|--------|--------|--------|--------|----------------------|-------|
| <u>2</u> | 178.3 | 46.5 | 41.1 | 71.1 | 38.7 | 35.3 | 132.3 | 108.5 | 149.2 | 134.0 | 143.5 | 102.4 |
| <u>3</u> | 178.5 | 46.5 | 41.1 | 71.7 | 38.4 | 35.3 | 131.7 | 108.8 | 148.0 | 146.5 | 108.3 | 121.6 |
| <u>4</u> | 178.7 | 46.6 | 41.1 | 71.2 | 38.4 | 34.7 | 131.7 | 108.8 | 148.0 | 146.4 | 108.3 | 121.6 |
| <u>5</u> | 178.2 | 52.7 | 36.5 | 72.7 | 39.7 | 72.1 | 132.2 | 108.5 | 149.1 | 133.9 | 143.2 | 102.2 |
| <u>6</u> | 178.3 | 52.7 | 36.3 | 72.0 | 39.3 | 72.0 | 131.3 | 108.4 | 147.7 | 146.1 | 107.8 | 121.4 |
| | C-1" | C-2" | C-3" | C-4" | C-5" | C-6" | OMe-3" | OMe-4" | OMe-5" | OMe-5' | O-CH ₂ -O | |
| <u>2</u> | 133.3 | 106.4 | 153.3 | 137.1 | 153.3 | 106.4 | 56.2 | 60.8 | 56.2 | 56.8 | 101.4 | |
| <u>3</u> | 133.4 | 106.4 | 153.3 | 137 | 153.3 | 106.4 | 56.1 | 60.8 | 56.1 | - | 101.4 | |
| <u>4</u> | 130.2 | 111.2* | 121.4 | 149.2 | 121.4 | 111.3* | 55.4 | 55.4 | - | - | 101.1 | |
| <u>5</u> | 136.5 | 102.4 | 153.4 | 137.5 | 153.4 | 102.4 | 56.2 | 60.8 | 56.2 | 56.8 | 101.4 | |
| <u>6</u> | 136.6 | 102.2 | 153.2 | 137.2 | 153.2 | 102.2 | 56.0 | 60.8 | 56.0 | - | 101.1 | |



2 $R = R' = \text{OMe}$

3 $R = \text{H} \quad R' = \text{OMe}$

4 $R = R' = \text{H}$



5 $R = \text{OMe}$

6 $R = \text{H}$ (Podorhizol)¹²

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- 5- J. Harmatha, M. Budezinsky and A. Teka, *Coll. Czech. Chem. Comm.*, 1982, 47, 644.
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- 7- Spectral data for $\bar{2}$ and $\bar{5}$
 $\bar{2}$: IR (CCl₄, ν cm⁻¹) 2940-2915, 2840, 1760, 1585, 1500, 1235; ms: m/z 430 (M⁺, 91), 265 (5), 238 (3.8), 191 (9), 181 (100), 165 (38.5), 161 (9), 151 (18), 135 (19); ¹H nmr (5, ppm): 6.36 (s, H-2" and H-6"), 6.17(d, H-2'), 6.15(d, H-6'), 5.94(dd, O-CH₂-O), 4.18(q, H-4b), 3.87(q, H-4a), 3.85(s, OMe-5), 3.83(s, OMe-3" and OMe-5"), 3.82(s, OMe-4"), 2.91(m, H-6a and H-6b), 2.60 (m, H-2), 2.55(m, H-5a and H-5b), 2.48(m, H-3) (J_{2,6}: 5.4 Hz, J_{3,4a}: 7.0 Hz, J_{3,4b}: 7.2 Hz, J_{4a,4b}: 9.0 Hz, J_{6a,6b}: 14 Hz, J_{2',6'}: 1.8 Hz, J⁰-CH₂-O: 5 Hz)
 $\bar{5}$: α ^D: -20.5 α (CHCl₃, c=1); mp: 112-113 α ; IR (KBr, ν cm⁻¹) 3435, 2840, 1750, 1580, 1400, 940; ms: m/z 446 (M⁺, 12.8), 197 (100), 181 (35.7), 165 (11.4); ¹H nmr (δ , ppm): 6.50 (s, H-2" and H-6"), 6.01(s, H-5'), 5.95(s, H-2'), 5.91(d, O-CH₂-O), 5.27(d, H-6), 4.37(q, H-4b), 3.96(q, H-4a), 3.82(s, OMe-5', OMe-5", OMe-3", OMe-4" and OMe-5"), 2.81(m, H-3), 2.63(m, H-2), 2.43(m, H-5b), 2.23(m, H-5a) (J_{2,3}: 6 Hz, J_{2,6}: 5.7 Hz, J_{3,4a}: 7.8 Hz, J_{4a,4b}: 8.9 Hz, J_{5a,5b}: 13.7 Hz, J_{5a,3}: 7.7 Hz, J_{5b,3}: 7.8 Hz, J_{2',6'}: 1.4 Hz, J⁰-CH₂-O: 1.0 Hz).
- 8- CD (EtOH) $\Delta\epsilon$ _{nm}: $\bar{2}$: -3.5₂₃₉, -0.9₂₇₈; $\bar{3}$: -2.6₂₄₀, -0.2₂₈₀; $\bar{5}$: -3.8₂₄₁, -0.9₂₈₀
- 9- Yateins also present in the plant² and has been previously isolated by H. Erdtman and J. Harmatha, *Phytochemistry*, 1979, 18, 1495; also by S.K. Koul, S.C. Tanaja, K.L. Dhar and C.K. Atal, *Phytochemistry*, 1983, 22, 999.
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