

CONFIRMATION OF THE STRUCTURE OF AN APIOSYLGLUCOSE DIBENZOATE FROM *DAVIESIA LATIFOLIA* BY TWO-DIMENSIONAL NMR TECHNIQUES

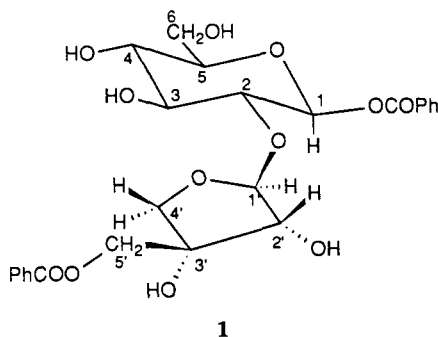
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In 1890, Bosisto reported (1) the isolation of a crystalline bitter substance ("daviesine") from the leaves of the small Australian shrub *Daviesia latifolia* R. Br. (Leguminosae) that was known by the early settlers in southeastern Australia as the "native hop bush," and used, among other things, as a tonic and a remedy for hydatids and low fevers (1-3). Paul and Cownley (4) suggested that Bosisto's compound was a "plant sugar," or more probably a glycoside. Subsequently, Power and Salway (5) (Burroughs, Wellcome & Co.) carried out a detailed chemical examination of the plant and concluded that Bosisto's bitter principle was a dibenzoyl derivative of glucoxylose, a "new disaccharide" (6). We recently undertook the elucidation of the structure of this compound by 2D $^1\text{H}/^{13}\text{C}$ correlation nmr spectroscopy, COSY, and by use of nOe's. Having reached the conclusion that the pentose of the disaccharide must be apiose rather than xylose, we found via reviews on the chemistry of apiose (7,8) that Lindberg and co-workers (9)¹ had studied this disaccharide some 20 years ago and had deduced that it is 2-*O*- β -D-apiosyl-D-glucose 1 β ,5'-dibenzoate [**1**]. The evidence for this structure was sound, but the stereochemistry of the apiose moiety was not proven beyond doubt. No significant nmr data for this compound have been published.



We now present nmr results that enable complete assignment of the ^1H and ^{13}C spectra of **1**, the 3,4,6,2',3'-pentaacetyl derivative and the 3,4,6,2'-tetraacetyl derivative of **1** (Table 1), and nOe results that confirm the stereochemistry of **1** (Table 2).

The assignments clearly demonstrate that the apiose is joined to glucose by a 1',2 linkage; the small coupling constant between H-1' and H-2', as pointed out by Lindberg and co-workers (9), indicates a β linkage for the apiose. The nOe's observed between H-2' and the protons on C-5' (as well as the ortho protons on the 5'-benzoate group) clearly indicate the *cis* relationship between H-2' and C-5'. Long-range couplings were observed between H-1 and the benzoate carbonyl at δ 165.3 and between the 5'-protons and the benzoate carbonyl at δ 166.2, clearly demonstrating the positions of benzylation.

EXPERIMENTAL

GENERAL EXPERIMENTAL PROCEDURES.—
Nmr spectra were recorded on a Bruker AM300

¹This paper was not indexed under *Daviesia latifolia* in the Collective Index of Chemical Abstracts for the years 1967-1971; therefore, we were originally unaware of it.

TABLE 1. ¹H- and ¹³C- Assignments^a for **1** and Acetyl Derivatives.

Atom	Compound					
	1 ^b		3,4,6,2',3'-Pentaacetyl derivatives ^c		3,4,6,2'-Tetraacetyl derivative ^c	
	¹ H	¹³ C	¹ H	¹³ C	¹ H	¹³ C
1	6.55 d(8.0)	94.5	5.92 d(8.0)	92.7	5.94 d(8.0)	92.7
2	4.49	78.5	4.00 dd(9.2, 8.0)	77.3	3.96 dd(9.3, 8.0)	76.5
3	4.38	78.5	5.32 dd(9.6, 9.2)	74.4	5.33 dd(9.6, 9.3)	74.4
4	4.32	70.9	5.10 dd(9.9, 9.6)	68.0	5.09 dd(10.0, 9.6)	68.0
5	4.05	79.4	3.90 ddd(9.9, 4.5, 2.0)	72.6	3.90 ddd(10.0, 4.6, 2.1)	72.6
6	4.36	61.6	4.10 dd(12.5, 2.0)	61.6	4.09 dd(12.5, 2.1)	71.6
	4.47		4.32 dd(12.5, 4.5)		4.31 dd(12.5, 4.6)	
1'	6.46 d(1.1)	110.9	5.15 brs	107.3	5.24 d(1.0)	107.8
2'	4.64 d(1.1)	78.3	5.25 brs	76.5	4.94 d(1.0)	79.0
3'		78.5		83.4		78.5
4'	4.29 d(9.5)	75.0	3.93 d(10.2)	72.9	3.69 d(10.0)	74.3
	4.43 d(9.5)		4.06 d(10.2)		3.80 d(10.0)	
5'	4.72 s	67.9	4.79 d(12.3)	63.2	4.38 d(11.8)	67.0
			4.59 d(12.3)		4.27 d(11.8)	
1-Benzoate		165.3		164.4		164.4
		130.1		129.5		129.5
	8.34 2H	130.3	8.09 2H	130.1	8.12 2H	130.2
	7.37 2H	128.8	7.55 2H	128.4	7.55 2H	128.4
	7.48 1H	133.8	7.39 1H	133.7	7.43 1H	133.8
5'-Benzoate		166.2		165.6		166.3
		130.4		128.8		128.8
	7.98 2H	129.8	7.86 2H	129.7	7.93 2H	129.5
	7.35 2H	128.6	7.55 2H	128.3	7.55 2H	128.4
	7.51 1H	133.2	7.39 1H	133.1	7.43 1H	133.3
CH ₃			1.95 (3H)	20.9	2.03 (3H)	20.6 × 4
			2.03 (3H)	20.6 × 4	2.05 (6H)	
			2.05 (6H)		2.13 (3H)	
CO				169.0		169.7 × 3
				169.5		170.5
				169.7		
				169.9		
				170.5		

^aAssignments done using Bruker XHCCORR pulse sequence.^bd⁸-pyridine solution.^cCDCl₃ solution.TABLE 2. Selected nOe's Observed for Acetyl Derivatives of **1**.

Proton Irradiated	nOe Observed	
	3,4,6,2',3'-Pentaacetyl derivative	3,4,6,2'-Tetraacetyl derivative
H-1	^a	H-3 (3%)
H-2	H-1' (6%)	H-5 (6%)
H-1'	H-2 (10%)	H-1' (7%)
H-2'	H-5'a (0.7%)	H-4 (4%)
	H-5'b (0.4%)	H-2 (10%)
		H-5'a (1%)
		H-5'b (1%)
		ortho protons on 5' benzoate (0.5%)
H-5'a	H-2' (2.7%)	H-2' (1.5%)
H-5'b	H-2' (1.2%)	H-2' (1.5%)

^aThe nOe's were not determined.

instrument, operating at 300 MHz for proton resonance and 75 MHz for carbon resonance. Unless otherwise stated, spectra were recorded in CDCl_3 , and chemical shifts are expressed in δ units from TMS. Correlated spectra were obtained using standard Bruker pulse sequences: COSY, XHCORR with delays optimized to observe $J = 125$ Hz for short range correlations and $J = 10$ Hz for long range correlations. The nOe's reported were obtained from nOe difference spectra.

PLANT MATERIAL.—A collection of the leaf of *D. latifolia* was made in April 1979, near Narbethong, Victoria, and a voucher specimen (CBG 8007999) is deposited at the Australian National Botanic Gardens, Canberra.

ISOLATION OF 2-O- β -D-APIOSYL-D-GLUCOSE 1 β ,5'-DIBENZOATE [1].—The dried, milled leaves were extracted as previously described (5). The crude disaccharide was purified by vacuum liquid chromatography (10,11) on Kieselgel 60G (Sil gel). A slurry of the crude compound with Kieselgel 60G EtOAc was evaporated and the dry powder added to the top of a dry-packed column (ca. 40 g) of Kieselgel 60G. The column was eluted successively (in vacuum) with EtOAc and with EtOAc containing increasing proportions of iPrOH. EtOAc containing 8% of iPrOH yielded a crystalline solid that, upon successive recrystallizations from EtOAc and H_2O , gave needles that melted at $152\text{--}154^\circ$, resolidified, and finally melted at $160\text{--}161.5^\circ$ [lit. (5) $147\text{--}148^\circ$, lit. (9) $148\text{--}159^\circ$], $[\alpha]_{\text{D}} - 105.6^\circ$ ($c = 0.83$ in MeOH) [lit. (9) -106°].

ACETYL DERIVATIVES.—The acetyl derivatives were prepared as described by Hansson *et al.*

(9) and separated by chromatography on Kieselgel 60G by elution with EtOAc-hexane (1:1) (10).

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