

The Chemical Constituents of Australian *Flindersia* Species. XXII* Some Extractives of *F. brassii*

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Abstract

From the bark of *Flindersia brassii* Hartley & Hyland, a new substance, flinderbrassin, $C_{31}H_{40}O_{12}$, m.p. 215°, $[\alpha]_D^{18} -8.2^\circ$, was isolated; it was reserved for further study. The leaves gave a very small yield of brassilignan, shown to be the known (-)-*trans*-3,4-bis(3,4-dimethoxybenzyl)tetrahydrofuran.

Recently the new species *Flindersia brassii* Hartley & Hyland has been discovered and described.¹ The tree, which occurs in dry rocky rain forest areas of the Cook district of northern Queensland, is medium to rather large, 13-30 m tall and 20-40 cm diameter at breast height. Through the kindness of its discoverers, who supplied the material, we have been able to examine the constituents of the bark and leaves.

The bark was extracted and the extracts worked up in the usual way² but the only isolable constituent was a new substance, flinderbrassin, $C_{31}H_{40}O_{12}$, m.p. 215°. Since a preliminary examination indicated that its structure was quite complex, it was reserved for further study.

The leaves also gave only one isolable constituent in very low yield. This was a substance, brassilignan, $C_{22}H_{28}O_5$, m.p. 120°, $[\alpha]_D^{23} -56^\circ$. Its infrared spectrum showed the absence of hydroxyl or carbonyl groups and a brief examination of its n.m.r. spectrum showed that the molecule contained four methoxyl groups but no C-methyl groups, and a high degree of symmetry to cause the exact doubling of peaks. In the mass spectrum, the only significant fragment ions were at m/e 152 (90%) and 151 (100%) corresponding to $C_9H_{12}O_2^+$ and $C_9H_{11}O_2^{+\cdot}$ respectively. It was therefore concluded that brassilignan was probably *trans*-3,4-bis(3,4-dimethoxybenzyl)-tetrahydrofuran (1). Only one other lignan, sesamin, has been reported from a member of the genus, *F. pubescens* Bail.,³ but lignans are not uncommon in other rutaceous genera (e.g.⁴).

No natural lignan of structure (1) has been previously described but the substance has been prepared synthetically and from other lignans on several occasions. The constants recorded are: m.p. 118-119°, $[\alpha]_D^{17} -58.9^\circ$,⁵ m.p. 117-118°, $[\alpha]_D^{25} -54.5^\circ$,⁶

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¹ Hartley, T. G., and Hyland, B. P. M., *J. Arnold Arbor., Harv. Univ.*, 1975, 56, 243.

² Picker, K., Ritchie, E., and Taylor, W. C., *Aust. J. Chem.*, 1976, 29, 2023.

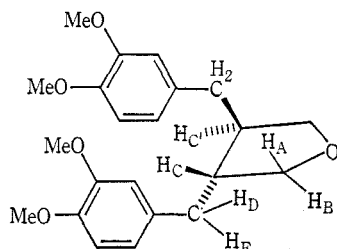
³ Hollis, A. F., Prager, R. H., Ritchie, E., and Taylor, W. C., *Aust. J. Chem.*, 1961, 14, 100.

⁴ Corrie, J. E. T., Green, G. H., Ritchie, E., and Taylor, W. C., *Aust. J. Chem.*, 1970, 23, 133.

⁵ Haworth, R. D., and Woodcock, D., *J. Chem. Soc.*, 1939, 1054.

⁶ Haworth, R. D., and Wilson, L., *J. Chem. Soc.*, 1950, 71.

m.p. 118.8–119.8°, $[\alpha]_D^{21} -46^\circ$.⁷ For the (+)-isomer the values reported are: m.p. 117°, $[\alpha]_D^{30} +50^\circ$,⁸ m.p. 114–116°, $[\alpha]_D^{30} +53^\circ$,⁹ for the (±)-form, m.p. 90–90.5°,¹⁰ and for the *meso*-isomer, m.p. 120–120.4°.¹⁰



(1)

Although the agreement between the best values and the values for brassilignan was good, structure (1) was confirmed by a detailed examination of the n.m.r. spectral data. In the ^1H n.m.r. spectrum a multiplet centred at about δ 6.6 could be assigned to H 2, H 5 and H 6 of two identical 3,4-dimethoxybenzene residues; the pattern was matched by iterative computation (LAOCN3) yielding the following parameters: δ_2 6.59, δ_5 6.75, δ_6 6.63, $J_{2,5}$ 1.97, $J_{2,6}$ 0.60, $J_{5,6}$ 7.95 Hz. The aliphatic region contained, in addition to singlets due to methoxyl at 3.84 and 3.83, five multiplets: four sets of doublets of doublets which could be assigned to the pairs of geminal protons H_A , H_B and H_D , H_E , and a broadened sextet attributable to H_C . A non-iterative computation, treating the system as one of five spins and using the following parameters: δ_A 3.89, δ_B 3.52, δ_C 2.18, δ_D 2.62, δ_E 2.53, J_{AB} 8.5, J_{AC} 6.8, J_{BC} 6.6, J_{CD} 6.5, J_{CE} 6.5, and J_{DE} 13.0 Hz, reproduced the spectrum to a good approximation, but not exactly since magnetic non-equivalence demands that the system be treated as one of a ten spins; computational facilities to do this were not available. Although the value of $J_{CC'}$ could not therefore be obtained the substituents on the heterocyclic ring are *trans*-disposed by virtue of the optical activity of the molecule. The noise-decoupled and single frequency off-resonance decoupled ^{13}C n.m.r. spectra of brassilignan were fully in accord with structure (1).

From the work of Row *et al.*⁹ on the (+)-form of (1), the absolute configuration of brassilignan is 3*R*,4*R*, as shown.

Experimental

General directions are as in Part XXI.² ^{13}C n.m.r. spectra were determined at 20 MHz on a Varian Associates CFT-20 instrument. Resonances showed the expected multiplicity on single frequency off-resonance decoupling.

The plant material was collected at Iron Range, northern Queensland, by Mr B. P. M. Hyland (sample number: Hyland 2734 (CANB, QRS)).

Extraction of the Bark

The dried, ground bark (10.5 kg) was extracted by percolation at room temperature with ether and then methanol. Alkaloids were absent from each extract.

⁷ Schrecker, A. W., and Hartwell, J. L., *J. Am. Chem. Soc.*, 1955, **77**, 432.

⁸ Row, L. R., Srinivasulu, C., Smith, M., and Rao, G. S. R. S., *Tetrahedron*, 1966, **22**, 2899.

⁹ Row, L. R., Satyanarayana, P., and Rao, G. S. R. S., *Tetrahedron*, 1967, **23**, 1915.

¹⁰ Schrecker, A. W., *J. Am. Chem. Soc.*, 1957, **79**, 3823.

The ether extract was concentrated and the solution extracted rapidly with 4% aqueous sodium hydroxide. After recycling there were obtained an acidic fraction (12 g) and a neutral fraction (15 g).

Both acidic fractions were chromatographed on silica gel, but only material consisting essentially of fatty acids could be isolated. It was not further examined.

The neutral fractions were combined and chromatographed on alumina. Only the fraction eluted by ether-benzene (3 : 1) gave crystalline material (11.3 g). Recrystallization from methanol afforded *flinderbrassin* as colourless rectangular prisms, m.p. 215°, $[\alpha]_D^{18} - 8.2^\circ$, $[\alpha]_{365}^{18} + 132^\circ$ (c, 0.7) (Found: C, 61.5; H, 6.6; O, 31.8; M^+ , 604.2543. $C_{31}H_{40}O_{12}$ requires C, 61.6; H, 6.7; O, 31.8%; M^+ , 604.2518). λ_{\max} 235sh, ϵ 7000; ν_{\max} 1755, 1730, 1611, 1504, 1315, 1245, 1225, 1166, 1142, 1060, 1042, 1028, 984, 950, 940, 900, 880, 818, 800, 750 cm^{-1} .

Extraction of the Leaves

The dried, milled leaves (4.5 kg) were extracted in turn with light petroleum, ether and methanol. Alkaloids were absent from each of the extracts, which were processed as above.

The acidic fractions (15 g, 30 g, and 3 g respectively) again appeared to consist of fatty acids and were not further examined.

The light petroleum neutral fraction (145 g) on chromatography on alumina gave fractions consisting only of paraffins and long chain alcohols. The same result was obtained from material which was saponified prior to chromatography.

The ether and methanol neutral fractions (97 g and 15 g respectively) were separately chromatographed on alumina but no crystalline fractions were obtained. The eluates from both chromatographs were combined and the material saponified with 10% aqueous ethanolic potassium hydroxide in the usual manner. The neutral portion (40 g) was chromatographed on alumina. Only the fraction eluted by ethyl acetate-benzene (1 : 1) contained crystalline material. This was rechromatographed. Elution by ethyl acetate-benzene (1 : 3) gave a colourless solid which on recrystallization afforded brassilignan, m.p. 120°, as colourless needles (Found: M^+ , 372.1933. Calc. for $C_{22}H_{28}O_5$: M^+ , 372.1936). The final yield was only 0.1 g, but much material was accidentally lost. ν_{\max} 1602, 1585, 1504, 1266, 1243, 1196, 1161, 1147, 1109, 1060, 1030, 950, 921, 875, 826, 813, 766, 742, 720 cm^{-1} . ^{13}C n.m.r. spectrum: 148.8, 147.5, ArC 3,4; 133.0, ArC 1; 120.6, ArC 6; 112.0, 111.2, ArC 2,5; 73.3, OCH_2 ; 55.8, OCH_3 ; 46.6, CH; 39.1, ArCH_2 . Mass spectrum, m/e 372 (70%), 152 (90), 151 (100), 137 (8), 212 (10), 107 (7), 106 (5).

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