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THE STRUCTURES OF OHCHINOLIDE A AND B, TWO NEW LIMONOIDS FROM *MELIA AZEDARACH* LINN. *VAR. JAPONICA* MAKINO[1)]

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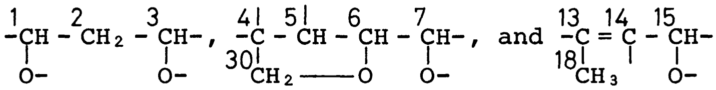
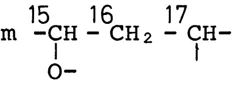
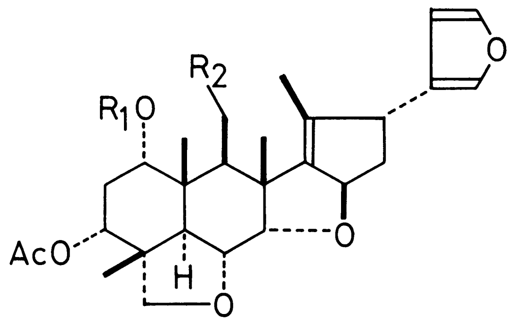
Two new limonoids, ohchinolide A and B, have been isolated from the fruit of *M. azedarach* Linn. *var. japonica* Makino and their structures established to be **1** and **2** by spectral correlations and an X-ray diffraction method.

In previous papers,[1,2)] we have described the isolation of three limonoids of biogenetic interest from *M. azedarach* Linn. *var. japonica* Makino. Our continuing search for limonoids in this plant has now led to isolation of two congeners which biogenetically link two classes of limonoids, meliacan and salannin. We report herein evidence for structures of these new limonoids designated as ohchinolide A and B.

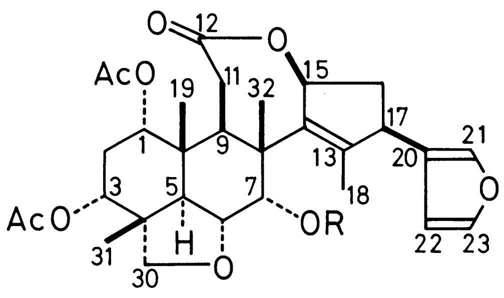
Ohchinolide A (**1**) was isolated as colorless prisms, $C_{37}H_{42}O_{10}$, mp 223-226 °C, $[\alpha]_D^{23}$ -53° (*c* 0.14, $CHCl_3$), in 0.001% yield from the ether extracts of the dry fruit by careful silica gel column chromatography, and exhibited the following spectral data. IR (KBr): 3080, 1730, 1640, 1605, 1590, 1505, and 875 cm^{-1}; UV (EtOH): 228, 275, and 282 nm (ε 15700, 1150, and 860); ^1H NMR: Table 1; ^{13}C NMR: Table 2. These data suggest that **1** has one tetrasubstituted double bond, one β-substituted furan ring, one benzoate and two acetate groups, and, one vinylic and three quaternary methyls. In addition, the ^1H and ^{13}C NMR data showed the presence of three groupings,  $-\underset{\mathrm{O-}}{\overset{1}{\mathrm{CH}}}-\overset{2}{\mathrm{CH_2}}-\underset{\mathrm{O-}}{\overset{3}{\mathrm{CH}}}-$, $-\underset{^{30}\mathrm{CH_2}\text{———}}{\overset{4}{\mathrm{C}}}-\overset{5}{\mathrm{CH}}-\underset{\mathrm{O}}{\overset{6}{\mathrm{CH}}}-\underset{\mathrm{O-}}{\overset{7}{\mathrm{CH}}}-$, and $-\underset{^{18}\mathrm{CH_3}}{\overset{13}{\mathrm{C}}}=\underset{|}{\overset{14}{\mathrm{C}}}-\underset{\mathrm{O-}}{\overset{15}{\mathrm{CH}}}-$, each carbon atom being assigned as shown with references to the structures of ohchinal (**3**) and ohchinin acetate (**4**).[2)] The lack of the ^{13}C NMR signal characteristic for C-15 of salannin type limonoids around δ 88 and the paramagnetic shift of the ^1H NMR signal due to H-7 indicate the absence of C_7-O-C_{15} ether linkage which exists in **3** and **4**. Alternatively the presence of a lactone ring was revealed by the partial hydrolysis of **1**. Treatment of **1** with 10% aq-Na_2CO_3, followed by methylation with CH_2N_2, gave the methyl ester (**5**), $C_{38}H_{46}O_{11}$, mp 171-174 °C, the IR spectrum of which shows a hydroxylic absorption at 3520 cm^{-1}. Of the locations of the lactone ring, $C_{12}-C_1$ and $C_{12}-C_{15}$, possible from biogenetic considerations, the former is rejected by the following reason. In the ^1H NMR spectrum of 6,[3] the signals due to H-1 and H-3 appeared as two doublets of doublets [H-1: δ 4.40 (J=13 and 5 Hz); H-3: δ 4.82 (J=10 and 5 Hz)],[4] whereas those of 1 were observed as two triplets, the shapes and positions of which rather corresponded to those of 7.[5] Furthermore, the correspondence of the ^1H NMR signals for H-1 and H-3 of 1 to those of 7 and the appearance of H-7 signal of 1 at abnormally lower field (δ 5.91), compared with that of 7 (δ 4.18), suggest disposition of two acetate groups at C-1 and C-3, and the benzoate group at C-7.

The ^1H NMDR studies of 5 for the system  $\overset{15}{-\underset{|}{\underset{\text{O-}}{}}CH} - \overset{16}{CH_2} - \overset{17}{\underset{|}{CH}}-$ reveal the chemical shift and coupling constant values as summarized in Table 1. From the examination of J values and the model, it is concluded that both protons at C-15 and C-17 are faced to the same side. The α-configuration for C_{17}-furan is common to all limonoids which have an intact C-ring,[6] and, hence, C_{17}-furan and C_{15}-lactone linkage of 1 must be β-oriented.

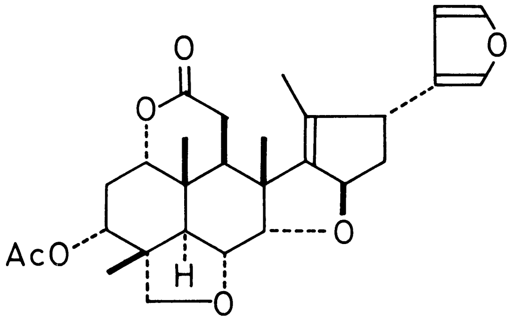
Although the evidence outlined strongly suggested the structure 1 for ohchinolide A, the final confirmation has been made by an X-ray diffraction method.



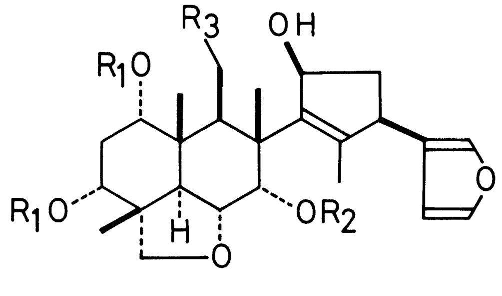
3 R_1 = COPh, R_2 = CHO
4 R_1 = Cin, R_2 = CO_2Me
7 R_1 = Ac, R_2 = CO_2Me



1 R = COPh
2 R = Tig



6

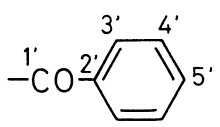


5 R_1 = Ac, R_2 = COPh, R_3 = CO_2Me
8 R_1 = R_2 = H, R_3 = CH_2OH

Table 1. ^{1}H NMR spectra of 1, 2, and 5 (solvent $CDCl_3$, δ values)[a)]

	1	2	5[b)]
H-1	4.85 t J=3	4.82 t J=3	4.54 t J=3
H-3	4.97 t J=3	4.98 t J=3	5.01 t J=3
H-5	2.99 d J=13	2.83 d J=13	3.13 d J=13
H-6	4.20 dd J=13, 3	4.13 dd J=13, 3	4.28 dd J=13, 3
H-7	5.91 d J=3	5.75 d J=3	5.70 d J=3
H-15	5.55 br d J=6	5.60 br d J=6	4.77 br d J=8
H-16α			ca. 1.80
H-16β			2.57 dd J=9.5, 8
H-17	3.36 br d J=6	3.43 br d J=6	3.34 dd J=9.5, 3.5
H-30	3.42 3.55 AB q J=8	3.51 3.56 Ab q J=8	
Furan	6.29, 7.23, 7.29	6.34, 7.30, 7.34	6.15, 7.11, 7.16
C-Me	1.11, 1.24, 1.55, 1.91	1.08, 1.22, 1.50, 1.86	1.24, 1.28, 1.56, 1.75
O-Ac	1.99, 2.24	2.04, 2.14	2.10, 2.14
Other	[OCOPh] 7.34-8.18	[OCOCMe=CHMe] H-3′ 6.99 q-like J=7 Me 1.86 br d J=7 1.95 br s	[OCOPh] 7.30-8.11

a) Coupling constants are expressed in Hz.
b) Added with D_2O.



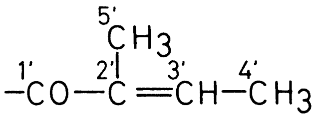


Table 2. ^{13}C NMR spectra of 1 and 2 (solvent $CDCl_3$, δ_C values, TMS as standard)

Carbon atom	1	2
1*	71.9 d	71.9 d
2	27.7 t	27.7 t
3*	72.0 d	71.9 d
4	42.5 s	42.4 s
5	40.7 d	40.6 d
6*	71.5 d	71.5 d
7	75.2 d	74.5 d
8	45.3 s	45.2 s
9	37.2 d	37.0 d
10	40.3 s	40.2 s
11	32.7 t	32.6 t
12	171.2 s	171.3 s
13	138.4 s	138.4 s
14	148.1 s	148.0 s
15	85.9 d	86.0 d
16	37.5 t	37.8 t
17	47.1 d	47.1 d
18	15.4 q	15.5 q
19	16.2 q	16.1 q
20	126.5 s	126.5 s
21	139.2 d	139.2 d
22	110.0 d	110.0 d
23	143.4 d	143.4 d
30	78.2 t	78.1 t
31	19.3 q	19.3 q
32	20.3 q	20.3 q
$OCOC̲H_3$	21.3 q 21.0 q	21.1 q 21.0 q
$OC̲OCH_3$	169.7 s 169.1 s	169.6 s 169.1 s
Other	[OCOPh]	[OCOCMe=CHMe]
C-1′	164.4 s	166.0 s
2′	130.3 s	128.6 s
3′	128.7 d	137.3 d
4′	129.2 d	14.6 q
5′	133.5 d	12.2 q

* These rows may be interchanged.

The stereo view of the molecule disclosed by the X-ray analysis is reproduced in Fig. 1. *Crystal data*: space group $P2_1$, a=16.284 (1), b=9.648 (1), c=10.700 (1) Å, β=98.08° (1), Z=2, Dx=1.29, Dm=1.30 g/cm^3, R=4.3%.

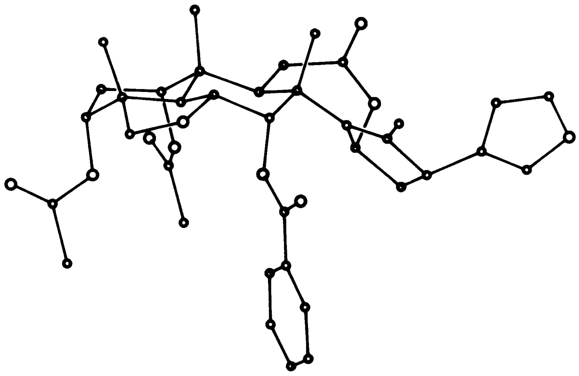


Fig. 1

Ohchinolide B (**2**) was obtained in 0.002% yield as colorless prisms, $C_{35}H_{44}O_{10}$, mp 201-204 °C, $[\alpha]_D^{23}$ -51° (c 0.12, $CHCl_3$), and displayed the spectral data similar to those of **1**. IR (KBr): 1725, 1650, 1508, and 875 cm^{-1}; UV (EtOH): end-absorption (ε_{210} 22800); ^{1}H NMR: Table 1; ^{13}C NMR: Table 2. The ^{1}H NMR spectra of **2** and **1** are distinct from one another only in the chemical shift of H-7 except the signals of acyl groups. These facts suggest that **2** has a structure close to that of **1**, in which the benzoate group of **1** is displaced by a tiglate group. This was confirmed by chemical correlation of **2** with **1**. Reduction of **2** with $LiAlH_4$ gave a pentaol (**8**), $C_{26}H_{38}O_7$, mp 153-156 °C, which was also obtained by a similar treatment from **1**. Therefore, structure **2** is assigned to ohchinolide B.

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