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LIGNANS FROM HERNANDIA OVIGERA LINN

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Our examination of the piscicidal constituent of a number of the medicinal plants found in Formosa resulted in the isolation of a new lignan (I) as a piscicidal constituent and another lignan (II) related to I from the leaves of *Hernandia ovigera* Linn. (*Hernandiaceae*), a seaside plant grown throughout the subtropical and tropical zone.

The evidences described herein born out that I is an epimer of aschantin (5) reported by Hänsel *et al.*[2] and II is an epimer of magnolin (6) by Kakisawa *et al.*[3] Therefore, we named I "epiaschantin" and II "epimagnolin".

Epiaschantin (I), m.p.123°, $[\alpha]_D^{19^\circ}$ +114° (c=0.5, $CHCl_3$), and epimagnolin (II), m.p.84°, $[\alpha]_D^{25^\circ}$ +112° (c=0.6, $CHCl_3$), were isolated from the ethyl acetate extract of the dried leaves by Florisil and Polyamide chromatography. Both compounds were obtained in a yield of ca. 0.2 % of the dried leaves.

Epiaschantin (I) exhibited about 8 % toxicity of pentachlorophenol, however, II had no toxicity.

Epiaschantin (I)

From the elemental analytical figures and the M^+ peak (m/e 400), $C_{22}H_{24}O_7$ was assigned to I.

The ir spectrum (CCl_4) had bands at 2775, 940 ($O-CH_2-O$), 2830 ($O-CH_3$), 1595, 1505 (benzene ring), 1240 and 1135 cm^{-1} (C-O-C)

The uv (EtOH 229, ε 13500, 285 nm, ε 4560), nmr[4] (3.84, 3H, s., $O-CH_3$, 3.87, 6H, s., $O-CH_3$X2, 6.61 ppm, 2H, s., aromatic protons, and, 5.96, 2H, s., $O-CH_2-O$, 6.81-6.93 ppm, 3H, m., aromatic protons) and MS[5] (m/e 207, 181, and, 149, 135) spectra indicated the presence of 3,4,5-trimethoxyphenyl and piperonyl groups.

After permanganate oxidation of I, esterification with diazomethane afforded methyl piperonylate which was identified with authentic specimen by tlc and glc (SE-30), while methyl 3,4,5-trimethoxybenzoate was not detectable. However analysis of the chemical shift positions of the aromatic protons according to Ballantine et al[6] pointed out the presence of 3,4,5-trimethoxyphenyl group (found 6.61, calcd. 6.35 ppm).

In the nmr spectrum two doublets ascribed to benzylic protons are shown at 4.43 (J=7Hz) and 4.84 ppm (J=5Hz)

Irradiation of the methine signal at 2.83 ppm (1H, m.) caused the doublet at 4.43 ppm to collapse to a singlet, whilst irradiation at 3 30 ppm (1H, m.) caused the doublet at 4 84 ppm to collapse

The remaining signals at 3.30 (1H, m.), 3.69-4.00 (2H, m.) and 4.02-4.20 ppm (1H, m.) were ascribable to protons of two methylene groups bearing the benzylic ether oxygen.

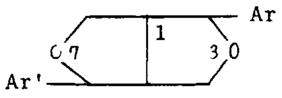
These nmr data and calculation of the degree of hydrogen deficiency pointed out that I is bicyclic compound made up of the groupings, $-\overset{|}{C}H-(Ar)CH-O-CH_2-$ and $-\overset{|}{C}H-(Ar')CH-O-CH_2-$, that is, a lignan containing a 3,7-dioxabicyclo [3.3.0] octane skeleton (1).

The nmr properties of aliphatic protons of I are very similar to those of epieudesmin (2) which was well examined by Birch et al[7]. (Table 1) Therefore, I is a compound which have one phenyl in the endo-position and the other in the exo-position.

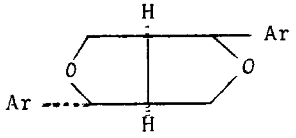
The application of the nmr shift reagent, Eu(DPM)$_3$, enabled us to deter-

Table 1

Protons	Epieudesmin (2)[7]	Epiaschantin (I)	Epimagnolin (II)
1-H	2.90 m.	2.83 m.	2.90 m.
5-H	3.30 m.	3.30 m.	3.30 m.
2-H	4 45 d (J=7Hz)	4.43 d. (J=7Hz)	4.47 d (J=7Hz)
6-H	4 85 d (J=5.5Hz)	4.84 d. (J=5Hz)	4.87 d. (J=5Hz)
4-H	4.10-4 40 m (1H)	4.02-4.20 m. (1H)	4.01-4.24 m. (1H)
	3 70-3.90 m. (2H)	3.69-4 00 m. (2H)	3.66-4.01 m. (2H)
8-H	3 25-3 45 m (1H)	3 30 m. (1H)	3.30 m. (1H)



(1)



(2) Ar=3,4-dimethoxyphenyl

mine the configuration of the phenyl groups.

The data in Table 2 revealed that the metal complexed the methoxyl group on C-4 of 3,4,5-trimethoxyphenyl group and that the benzylic proton doublet appeared at the lower field (*J*=5Hz, *trans* to one proton at the bridgehead) associated with 3,4,5-trimethoxyphenyl group because of the larger downfield shift as compared with the other benzylic proton doublet (*J*=7Hz, *cis* to another bridgehead proton) on addition of the shift reagent.

Table 2

				$Eu(DPM)_3$[a,b]			
		Signal	0 mg	5 mg	ΔHz[c]	10 mg	ΔHz[c]
I	3,4,5-Trimethoxy-phenyl	$4-OCH_3$	334d	364	30	395	61
		$3,5-OCH_3$	343	352	9	359	16
		2,6-H	582	599	17	617	35
	Piperonyl	$O-CH_2-O$	532	534	2	535	3
		2,5,6-H	608[e]	611.5[e]	3.5	614.5[e]	6.5
	Benzylic proton (J=7Hz)		386.5	392.5	6	398.5	12
	Benzylic proton (J=5Hz)		421.5	430.5	9	438.5	17
II	3,4,5-Trimethoxy-phenyl	$4-OCH_3$	336	340	4	-	-
		$3,5-OCH_3$	345	346	1	-	-
		2,6-H	584	588	4	-	-
	3,4-Dimethoxy-phenyl	$3or4-OCH_3$	340	353	13	-	-
		$3or4-OCH_3$	342	356	14	-	-
		2,5,6-H	611[e]	626.5[e]	15.5	-	-
	Benzylic proton (J=7Hz)		387.5	394.5	7	-	-
	Benzylic proton (J=5Hz)		422.5	424	1.5	-	-

a Added to a solution of 30 mg of I in 0.5 ml of CCl_4. b. Added to a solution of 29 mg of II in 0.5 ml of CCl_4. c Difference from 0 mg of $Eu(DPM)_3$. d: In Hz. e Center of the three proton multiplet.

Thus the *exo*-position was given to 3,4,5-trimethoxyphenyl group whereas the *endo*-position to piperonyl group.

From all of the above results, the structure (3) was elucidated for epi-aschantin (I).

Epimagnolin (II)

The molecular formula, $C_{23}H_{28}O_7$, was established by the elemental analysis and the M^+ peak (m/e 416).

The uv spectrum (EtOH) had absorptions at 231 (ε18000) and 279 nm (ε4010).

The ir spectrum (CCl_4 2830, 1595, 1505, 1238, 1133 cm^{-1}) resembles I except for the absence of methylenedioxy absorption.

The nmr spectrum exhibited five methoxyl groups (3.86, 3H s., 3.89, 9H, s., 3.90 ppm, 3H, s.) Chemical shifts and splitting patterns of aromatic protons (6.63, 2H, s., 6.90-7.00 ppm, 3H, m.) were similar to those of I.

These data indicated that II have 3,4,5-trimethoxyphenyl and 3,4-dimethoxyphenyl groups. This was supported by the prominent peakes[5] at m/e 207, 181 165, 151 and 135 in the mass specturm.

The nmr features of aliphatic protons (Table 1) showed that two phenyl groups of II were substituted in the <u>endo-exo</u> type.

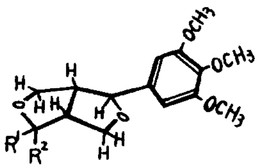
The nmr experiment with Eu(DPM)$_3$ (Table 2) showed the metal complexed methoxyl groups of 3,4-dimethoxyphenyl group and that the benzylic proton doublet with $\underline{J}$=7Hz is associated with 3,4-dimethoxyphenyl group.

Therefore we proposed the structure (4) for epimagnolin (II).

Differences in the optical rotation between epimers[8] (Table 3) supports the structures (3) and (4).

Table 3

	$[\alpha]_D$ in $CHCl_3$	Difference
(+)-Sesamin	+71°	49°
(+)-Episesamin	+120°	
(+)-Eudesmin	+64°	55°
(+)-Epieudesmin	+119°	
Aschantin (5)	+65°	49°
Epiaschantin (3)	+114°	
Magnolin (6)	+56°	56°
Epimagnolin (4)	+112°	



(3): R^1=H, R^2=piperonyl
(4): R^1=H, R^2=3,4-dimethoxyphenyl
(5) R^1=piperonyl, R^2=H
(6): R^1=3,4-dimethoxyphenyl; R^2=H

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<u>Footnotes and References</u>

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