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JUSTICIDIN C AND D, THE 1-METHOXY-2,3-NAPHTHALIDE LIGNANS, ISOLATED FROM JUSTICIA PROCUMBENS L.

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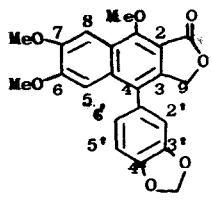
In the course of our investigations on the lignans of Justicia species we isolated from Justicia procumbens L. two new lignans belonging to a 1-methoxy-2,3-naphthalide type (I), for which we proposed the names justicidin C and D.* In this communication we wish to report the isolation and structure determination of these lignans.

For isolation, ethanol extracts of the air dried plant were chromatographed on silica gel. The fractions having blue fluorescence under the ultraviolet irradiation were eluted with hexane-ethyl acetate (3:1), and the eluates, after evaporation of the solvent, were recrystallized from hot ethyl acetate, affording pure justicidin C (0.004 % yield, m.p. 266°) and D (0.001 % yield, m.p. 272°).

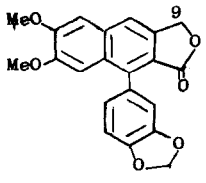
Justicidin C (II), $C_{22}H_{18}O_7$ [1] (M^+, m/e 394), had an IR absorption at 1753 cm^{-1} associated with an aromatic-γ-lactone. The UV spectrum, $\lambda_{max}^{CHCl_3}$ 260 sh., 265, 300, 317 and 355 mμ (ε 48200, 51430, 8210, 9640 and 3570), indicated the presence of an extended naphthalenic chromophore.[2] The NMR spectrum[3] recorded at 100 Mc. displayed three methoxyl signals (δ 3.83, 4.05 and 4.37), the former two of which were ascribed to the C_6- and C_7-methoxyl groups by the close similarity of their chemical shifts to those of corresponding ones of justicidin B (III)[4] (δ 3.80 and 4.03). The third signal at δ 4.37 was attributed to the methoxyl group attached at the C_1-carbon, the peri-position to the lactone carbonyl which deshielded the C_1-methoxyl group. The assignment was supported from the compound X to show the C_1-methoxyl signal at δ 4.36.[5] The signals due to the C_2, -(δ 6.83, s) and C_6,-protons (δ 6.78, dd, J=8 and 1 cps) were observed as Figure (i). The pattern of proton signals was compared with those of related compounds, that is, in the spectra of the compounds III[4] and IV,[6] the C_2,-proton singlet overlapped with

the lower one of double doublets of the $C_{6'}$-proton, and was also observed as Figure (i), while in those of the compounds V[7], VI[7] and VII[8], the $C_{2'}$-proton signal was seen being overlapped with the higher one of double doublets and observed as Figure (ii). These findings ascertained the location of the methylenedioxy group at the $C_{3',4'}$-position, signals at δ 5.12 (2H, q, J=1 cps), 6.97 (1H, d, J=8 cps), 6.99 (1H, s), and 7.70 (1H, s) were ascribed to the protons attached at the C_9-, $C_{5'}$-, C_5- and C_8-carbons, respectively.

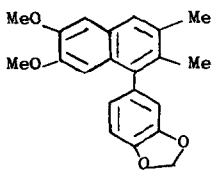
Recently compound II was synthesized by Z. Horii et al..[9] Justicidin C and the synthetic specimen were completely identical in the TLC, mixture melting point and IR spectra.



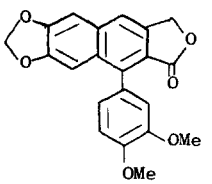
II



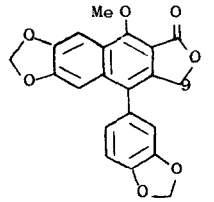
III



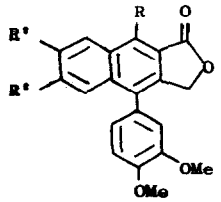
IV



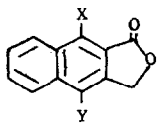
VI



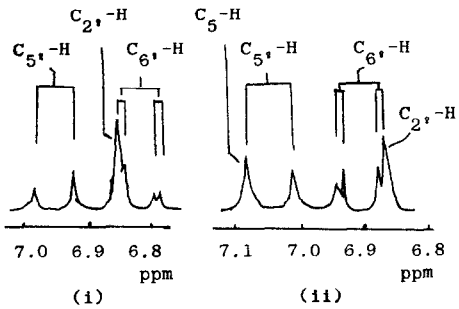
VIII



V; R=H, R'R''= $-OCH_2O-$
VII; R=H, R'=R''=OMe
X; R=OMe, R'R''= $-OCH_2O-$



I; X=OR, Y=Ar
IX; X=Ar, Y=OR
OR=OH or OMe



Justicidin D (VIII), $C_{21}H_{14}O_7$[1] (M^+, m/e 378), was revealed to have the same skeleton as that of justicidin C by the IR (ν^{CHCl_3} 1753 cm^{-1}) and UV spectra ($\lambda_{max}^{CHCl_3}$ 262, 300, 317 and 355 mμ (ε 39000, 8330, 9670 and 3330)). Furthermore, the NMR spectrum was also quite similar to that of justicidin C with the exception that two methoxyl signals appeared at δ 3.83 and 4.05 were disappeared and a singlet corresponding to four methylenedioxy protons was observed at 6.08. The signals due to the $C_{2'}$- and $C_{6'}$-protons were shown as Figure (i). On the basis of these spectral data, the structure of justicidin D was suggested to be as shown VIII, and all the signals were assigned as follows; δ 4.33 (3H, s, C_1 $-OCH_3$), 5.11 (2H, s, C_9 $-CH_2$), 6.08 (4H, s, $C_{6,7}$ -and $C_{3',4'}$ $-OCH_2O-$), 6.75 (1H, dd, J=8 and 1 cps, $C_{6'}$-H), 6.79 (1H, s, $C_{2'}$-H), 6.96 (1H, d, J=8 cps, $C_{5'}$-H), 6.99 (1H, s, C_5-H) and 7.71 (1H, s, C_8-H).

Justicidin C and D were thus concluded to be of 1-methoxy-2,3-naphthalide type (I) lignans. They were exceptional among the hitherto known α-oxigenated-2,3-naphthalide lignans, which were, in every case, shown to be of 4-methoxy (or hydroxy)-2,3-naphthalide type (IX), and the finding of new lignans belonging to type (I) let us have an interest in their biogenesis.

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Footnotes and References

1) Satisfactory elemental analysis was obtained.

2) (a) K. Munakata, S. Marumo, K. Ohta and Y. L-Chen, Tetrahedron Letters, No. 47, 4167 (1965).
(b) T. Murakami and A. Matsushima, J. Pharm. Soc. Japan, 81, 1596 (1961).
(c) H. Kofog and C. Jörgenson, Acta. Chem. Scand., 8, 1296 (1954).
(d) Y. -T. Lin, T. -B. Lo, K. -T. Wang and B. Weinstein, Tetrahedron Letters, No. 9, 849 (1967).

3) The NMR spectra were measured in $CDCl_3$ solution using TMS as an internal standard.

4) (a) K. Munakata, S. Marumo, K. Ohta and Y. L-Chen, Tetrahedron Letters, No. 39, 3821 (1967)
(b) see reference 2) (a).

5) Z. Horii and T. Momose, private communications.

6) R. Wallace, A. L. Porte and R. Hodges, J. Chem. Soc., 1445 (1963).

7) see reference 2)(b).

8) R. D. Haworth and G. Sheldrick, J. Chem. Soc., 636 (1935).

9). Z. Horii, K. Ohkawa, S. -W. Kim and T. Momose, Chem. Pharm. Bull., 17, 1878 (1969).

* Justicidin D and D have the piscicidal activities to killie-fish.