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Cinncassiol C_1, a Novel Type of Diterpene from Cinnamomi Cortex[1]

A new and highly functionalized diterpene, which had been isolated from the water extractive exhibiting anti-allergic activity of Cinnamomi Cortex and named cinncassiol C_1, was assigned the full structure VII by chemical, spectral and X-ray crystallographic study.

Keywords——diterpene; cinncassiol C_1; Cinnamomi Cortex; *Cinnamomum cassia*; Lauraceae; anti-allergic activity; X-ray

The isolation of a series of diterpenes (compounds I—X) from the water extractive exhibiting anti-allergic activity[2] of Cinnamomi Cortex ("Kannan Keihi," the dried bark of *Cinnamomum cassia* Blume (Lauraceae); one of the most widely used crude drugs), identifications of compounds I and II respectively with cinnzeylanine and cinnzeylanol[3] and structure elucidations of compounds III—VI were reported in the preceding paper.[4] This report provides an account of the structure determination of compound VII (named cinncassiol C_1), a novel and highly oxygenated tetracyclic diterpene, on the basis of chemical and spectroscopic evidence and by X-ray crystallographic analysis.

Cinncassiol C_1, colorless plates (MeOH), mp 204—207°, $[\alpha]_D$ $-3.6°$ (MeOH), $C_{20}H_{28}O_7$ (M^+ m/z 380), showed in its IR spectrum the absorptions due to hydroxyl (3440 cm^{-1}), carbonyl (1740 cm^{-1}), and α,β-unsaturated ketone (1650 cm^{-1}) functions. The UV spectrum (λ_{max}^{EtOH} 242 nm, $\varepsilon=6400$) also suggested the presence of an enone system. Its ^{13}C-NMR spectrum (in CD_3OD) exhibited the signals of twenty carbons including those of two carbonyls (δ 173.3 and 212.6), one hemiacetal (δ 104.7), one tri-substituted double bond (δ 127.9 and 159.3), and four carbons (δ 66.6, 71.7, 79.2 and 91.9) each bearing a hydroxyl or an ether oxygen atom. Supposing that cinncassiol C_1 is closely related in structure with the coexisting compounds I and II, the signals in the ^1H-NMR spectrum (in CD_3OD) were respectively assigned by comparison with those of compound II (cinnzeylanol) as follows; δ 0.98, 1.32 (3H each, both singlet, 9- and 12-*tert*-methyls, respectively), 0.97, 1.14 (3H each, both doublet(d) of $J=6$ Hz, 2- and 18-*sec*-methyls, respectively), 2.16, 2.43 (2H, AB quartet, $J=13$ Hz, 10-methylene), 3.36, 3.72 (1H each, doublet of doublet (d d), $J=8$, 11 Hz and d d, $J=6$, 11 Hz, respectively, 19-hydroxymethyl) and 3.65 (1H, d, $J=10$ Hz, 1-H). In addition, the signals due to an allylic proton (multiplet) around δ 2.65 and an olefinic proton at δ 5.80 are ascribable to 18-H (by spin decoupling experiment) and 14-H, respectively. Therefore, the double bond should be located between C-13 and -14, to which one of two carbonyls is adjacent to form α,β-unsaturated ketone. When the oxidative cleavage of glycol at C-7 and -8 in II is assumed to take place, all the above data could be reasonably interpreted by the speculative structural formula VII for cinncassiol C_1. In order to prove this tentative structure, X-ray crystallographic analysis was subsequently undertaken.

The crystal of cinncassiol C_1 employed was obtained by recrystallization from dil. MeOH and its data were as follows; $C_{20}H_{28}O_7 \cdot H_2O$; size, $0.15 \times 0.2 \times 0.3$ mm; monoclinic, space group $P2_1 (Z=2)$; lattice constants $a=17.034(4)$, $b=8.191(2)$, $c=7.148(1)$ Å, $\beta=100.73(2)°$, $V=979.91$ Å^3; $D_{(calcd.)}=1.350$, $D_{(obsd.)}=1.350$ $g \cdot cm^{-3}$. The intensity data of 1976 ($2\theta \leq$

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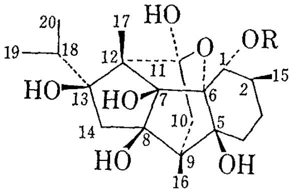
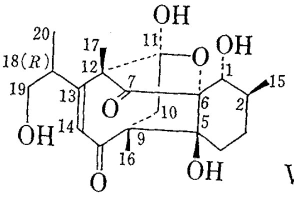

I : R=Ac
II : R=H


VII

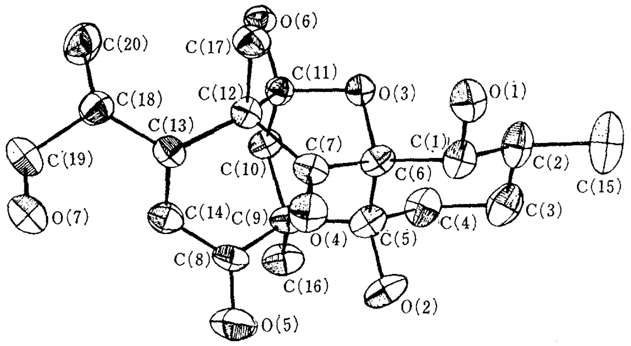


Fig. 1

50°) were measured with a Syntex P_1 full automated four-circle diffractometer using 2θ—θ scan technique and monochromated Mo(Kα) radiation (λ=0.71069 Å). The structure was solved *via* MULTAN program.[5] Block diagonal least-squares refinements with anisotropic nonhydrogen atoms and isotropic hydrogens have currently converged to a standard residual of 0.041 for the 1649 observed reflections ($I>2.3\sigma(I)$). A computer-generated perspective drawing thus obtained is shown in Fig. 1. Therefore, the molecular structure is represented by the formula VII as tentatively assigned or its enantiomer, the latter of which could be, however, excluded because the configurations, at C-2, -9 and -12 for example, are most likely identical with those of II. Cinncassiol C_1 is a novel and highly oxygenated tetracyclic diterpene, which possesses an eight-membered ring carrying two ketone functions in the molecule.

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