

STRUCTURE OF CRYPTOMERONE, A BISABOLANE SESQUITERPENE FROM CRYPTOMERIA JAPONICA

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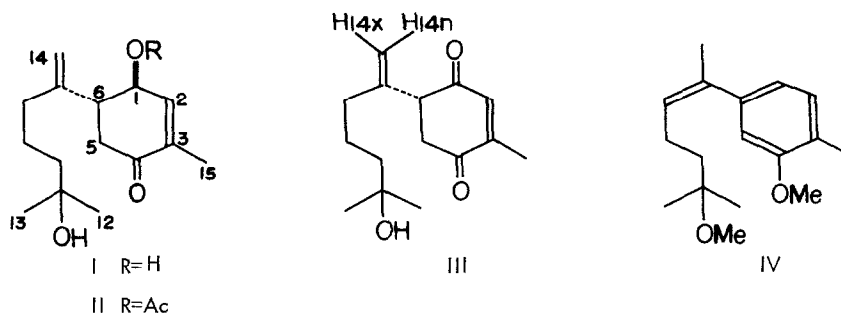
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Extensive chemical investigations of Cryptomeria japonica D. Don have culminated in the isolation of many terpenic and phenolic substances (1). Through an investigation of the wood of the Yaku variety of the species collected in Yaku island, Japan, we have isolated a new sesquiterpene ketoalcohol, cryptomerone. We wish to present herein evidence for the assignment of the structure I for this compound.

Methanol extract of the wood was subjected to distillation ($\sim 150^\circ/5$ mm Hg) and the residue was separated by alumina and silica gel chromatography. Cryptomerone (I) (2), $C_{15}H_{24}O_3$, liq. (λ_{max} 233.5 nm (ϵ 5370), ν 3370, 3060, 1678, 1645 sh, 903 cm^{-1}), 2,4-DNP, m.p. 194.5-195°, eluted with $CHCl_3$ -EtOH from silica gel, afforded an oily monoacetate (II), ν 3430, 1735, 1678, 904 cm^{-1} (on acetylation with Ac_2O -pyridine). The presence of two hydroxyls, an α,β -unsaturated carbonyl and a vinylidene groups in I was thus clearly demonstrated. The NMR spectrum (2) of I revealed the existence of the following groupings: Two tertiary methyls (δ 1.22, 6H s) on the carbon bearing hydroxyl, a methyl group attached to double bond (δ 1.79, 3H t, $J=1.5$), a carbonyl proton (δ 4.50, 1H dm, $J=8$) with at least one proton on adjacent carbon, exocyclic methylene (δ 5.01, 2H brs), and an olefinic proton (δ 6.70, 1H m). The presence of the α -methyl- α,β -unsaturated ketone system was suggested from 1) chemical shift of the olefinic proton (too low field for α -proton) and 2) the small benzene-induced solvent shift ($\delta_{CDCl_3} - \delta_{Bz} = -0.01$ ppm) of the methyl group (3,4).

The arrangement of the hydrogens on the ring was established by the NMR experiment on II. Irradiation at C_3 -methyl (δ 1.79) changed H_1 [dm at δ 5.68 \rightarrow dd ($J=9.2, 2.2$)] as well as H_2 [m at δ 6.51 \rightarrow d ($J=2.2$)] disclosing that H_1 has only one additional hydrogen (H_6) on the adjacent carbon. The H_6 (δ 2.78 ppm, ddd, $J=12.3, 9.2, 4.5$) changed to dd ($J=12.3, 4.5$) on irradiation at H_1 revealing the existence of two hydrogens at C_5 (5). Partial structure thus obtained was further confirmed by Jones' oxidation of I to give an enedione (III), $C_{15}H_{23}O_3$, λ_{max} 240 nm (ϵ 7320), ν 3420, 1680, 1627, 900 cm^{-1} , δ 1.21 (6H s, $H_{12}H_{13}$), 1.99 (3H d, $J=1.3$, H_{15}), 2.98 (2H d, $J=6.5$, H_5), 3.56 (1H brt, $J=6.5$, H_6), 4.84 (1H brs, H_{14x}), 5.02 (1H t-like, $J=1.5$, H_{14n}), 6.55 (1H m, H_2). Furthermore on treatment with hydrochloric acid in methanol I afforded an anisole derivative (IV), $C_{17}H_{26}O_2$, liq.



λ_{\max} 249, 280 nm (ϵ 8410, 2630), ν 1610, 1570, 1503, 842 cm^{-1} . NMR spectrum of IV clearly indicates the presence of a 1,2,4-trisubstituted benzene ring (δ 6.7-7.2, 3H), a trisubstituted double bond (δ 5.75, 1H brt, $J=6.5$) adjacent to methylene group, and two methoxys (δ 3.20, 3.83) besides two tertiary methyls (δ 1.19 s) and two vinylic methyls (δ 2.03 brs, 2.19, s).

The constitution of I having been determined, the stereochemistry of only two points, the side chain and the secondary hydroxyl group, remained to be elucidated. The large J_{16} (≈ 9.2 Hz) indicates a diequatorial conformation for the two substituents. Of the two possible absolute configurations, the one depicted was chosen on the basis of the positive Cotton effect in CD curves of I ($[\theta]_{334} +580$) and II ($[\theta]_{336} +1070$) (6).

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References and Footnotes

- 1) Cf. T. Kondo, H. Imamura and M. Suda, *Bull. Agr. Chem. Soc. Japan*, **23**, 233 (1959), **24**, 65 (1960). V.P. Arya, C. Enzell and H. Erdtman, *Acta. Chem. Scand.*, **15**, 682 (1961). T. Kondō, M. Suda and M. Tejima, *Yakugaku Zasshi (J. Pharm. Soc. Japan)*, **82**, 1252 (1962). M. Sumimoto, H. Ito, H. Hirai and K. Wada, *Chem. Ind.*, 780 (1963). K. Funaoka, Y. Kuroda, Y. Kai and T. Kondo, *J. Japan Wood Res. Soc.*, **9**, 139 (1963). S. Nagahama, *Bull. Chem. Soc. Japan*, **37**, 886, 1029 (1964). Y. Kai, *J. Japan Wood Res. Soc.*, **11**, 23 (1965), C. R. Enzell, Y. Hirose and B. R. Thomas, *Tetrahedron Letters*, 793 (1967).
- 2) Correct analytical figures were obtained for all compounds described in this paper. UV and CD spectra were measured in methanol and IR spectra were referred to liquid film unless otherwise stated. NMR measurement was carried out at 60 and/or 100 MHz in CDCl_3 . Chemical shift was expressed in ppm from internal TMS.
- 3) Y. Fujise and S. Itō, *Chem. Pharm. Bull.*, **14**, 797 (1966). C. Timmons, *Chem. Commun.*, 576 (1965).
- 4) The solvent shift of the vinyl proton is -0.24 ppm in agreement with the values for β -trans protons.
- 5) Other signals appear in the NMR of II are $\text{Me}_2\text{C}^{\delta}\text{OH}$ (1.22 ppm) CH_3COO^- (2.07 ppm), $\text{CH}_2=\text{C}^{\delta}$ (4.92 brs).
- 6) P. Crabbē, *Optical Rotatory Dispersion and Circular Dichroism in Organic Chemistry*, p. 231. Holden-Day, Inc., San Francisco (1965). K. Kuriyama, M. Moriyama, T. Iwata and K. Tori, *Tetrahedron Letters*, 1661 (1968).