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Structure of Lyoniol-D

A new toxic diterpenoid lyoniol-D was isolated along with lyoniol-A (lyoniatoxin) and lyoniol-B[1], from the extract of leaves of *Lyonia ovalifolia* DRUDE var. *elliptica* HAND.-MAZZ. by silica gel chromatography.

Lyoniol-D (I) (mp 201—203°), was obtained colorless fine needles from chloroform. *Anal.* Calcd. for $C_{22}H_{36}O_8 \cdot 1/2 \cdot H_2O$: C, 60.46; H, 8.53. Found: C, 60.38; H, 8.49. $[\alpha]_D^{27}$ +17.5° (c=0.317, MeOH). IR ν_{max}^{KBr} cm^{-1}: 3340, 1715, 1250. NMR $\delta_{ppm}^{C_5D_5N}$: 1.43 (3H, s), 1.48 (6H, s), 1.69 (3H, s), 2.18 (3H, s, $OCOCH_3$), 2.80 (1H, d, J=6.0 Hz, C^1–H), 3.88 (1H, d, J=2.5 Hz, C^3–H), 3.96 (1H, d, J=9.0 Hz, C^7–H), 4.95 (1H, q, J=2.5, 6.0 Hz, C^2–H), 5.41 (1H, d, J=9.0 Hz, C^6–H).

Acetylation of lyoniol-D gave a monoacetate (II) and diacetate (III). II: Colorless grains (from ethyl acetate), mp 241—242.5°. *Anal.* Calcd. for $C_{24}H_{38}O_9$ (monoacetyl lyoniol-D): C, 61.26; H, 8.14. Found: C, 60.81; H, 8.17. IR ν_{max}^{KBr} cm^{-1}: 3450, 1720, 1710, 1260. NMR $\delta_{ppm}^{C_5D_5N}$: 1.92, 2.16 (each 3H, s, $OCOCH_3$), 3.28 (1H, d, J=4.0 Hz, C^1–H), 3.92 (1H, d, J=5.0 Hz, addition of D_2O→s, C^3–H), 6.10 (1H, d, J=4.0 Hz, C^2–H). III: Colorless needles (from benzene) mp 231—233°. *Anal.* Calcd. for $C_{26}H_{40}O_{10} \cdot H_2O$ (diacetyl lyoniol-D): C, 58.92; H, 7.99. Found: C, 58.82; H, 7.69. IR ν_{max}^{KBr} cm^{-1}: 3450, 1720, 1255. NMR $\delta_{ppm}^{CDCl_3}$: 2.14 (6H, s, $OCOCH_3 \times 2$), 2.20 (3H, s, $OCOCH_3$), 2.60 (1H, d, J=4.0 Hz, C^1–H), 4.82 (1H, s, C^3–H), 5.47 (1H, d, J=4.0 Hz, C^2–H).

Penta-O-acetyl derivative of lyoniol-A[2] was hydrolyzed with alkali and then the crude product was acetylated at room temperature. One of the two acetylated products was identified with diacetate of lyoniol-D by direct comparison (a mixture melting point, infrared spectra and thin-layer chromatography). Therefore lyoniol-D must be a monoacetate of 2,3,5,6,7,10,-16-heptahydroxygrayanane.

Dibenzoate of lyoniol-D (IV) was formed with benzoyl chloride in pyridine. IV: Colorless grains from benzene. (mp 203—204°). *Anal.* Calcd. for $C_{36}H_{44}O_{10}$: C, 67.91; H, 6.97. Found: C, 67.67; H, 6.94. IR ν_{max}^{KBr} cm^{-1}: 3450, 3050, 1720, 1700, 1600, 1580, 1450, 710. NMR $\delta_{ppm}^{CDCl_3+d_6DMSO}$: 2.12 (3H, s, $OCOCH_3$), 2.77 (1H, d, J=3.0 Hz, C^1–H), 5.04 (1H, s, C^3–H), 5.78 (1H, d, J=3.0 Hz, C^2–H).

The monoacetate II gave 3-oxo-15,16-dehydro derivative (V) by chromic acid oxidation. White powder (from hexane). *Anal.* Calcd. for $C_{24}H_{30}O_8$: C, 63.98; H, 7.61. Found: C, 63.99; H, 7.44. IR ν_{max}^{KBr} cm^{-1}: 3500, 1760, 1710, 1645. NMR $\delta_{ppm}^{CDCl_3}$: 1.10, 1.12, 1.54 (each 3H, s.), 1.17 (3H, d, J=2.0 Hz, $H\rangle C{=}C\langle CH_3$), 2.43 (1H, br-s, C^1–H), 5.2—5.3 (1H, br-s, C^{15}–H), 5.45 (1H, s, C^2–H). Nuclear magnetic resonance (NMR) data of the monoacetate II and the oxo compound V suggested that the monoacetate is a 2-acetoxy-3-hydroxy derivative. The optical rotatory dispersion (ORD) curve of 2-acetoxy-3-oxo derivative is similar to that of 2-chloro-3-oxo derivative of lyoniol-A.[2] On the basis of this result and on the examination of octant diagrams of 2-acetoxy-3-oxo compounds, we concluded that the configuration of 2-acetoxyl group is α. Further the circular dichroism curve of 2,3-dibenzoyl lyoniol-D IV shows a negative chirality. Thus, according to dibenzoate chirality rule,[3] the configuration of dibenzoyloxy groups must be 2α, 3β.[4]

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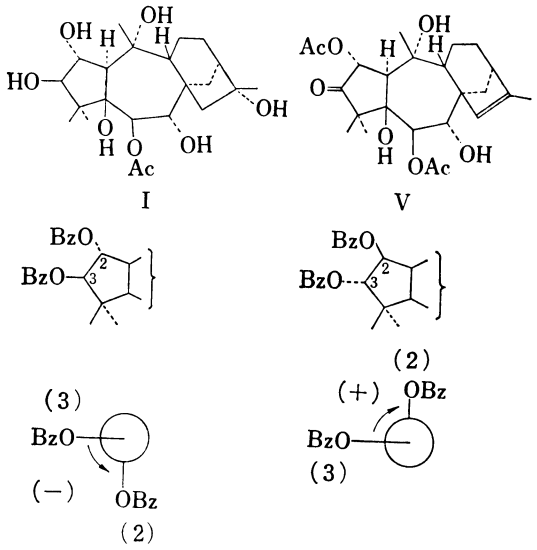
2) T. Kato, J. Sakakibara, and M. Yasue, *Yakugaku Zasshi*, **91**, 1194 (1971).
3) N. Harada and K. Nakanishi, *J. Am. Chem. Soc.*, **91**, 3989 (1969).
4) The configuration 2β, 3α of 2,3-O-acetyl groups in the penta-O-acetyl compound derived from lyoniol-A was revised as 2α, 3β.

Lyoniol-D did not from an acetonide with acetone and *p*-toluenesulfonic acid. Furthermore the monoacetate II does not consume any sodium periodate. Therefore, configuration of the 2,3-glycol on the cyclopentane ring is *trans* and the acetyl group must be attached to the C-6 oxygen atom, similar to lyoniol-A. From these facts and relationship to lyoniol-A, we propose the stereostructural formula I for lyoniol-D.



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