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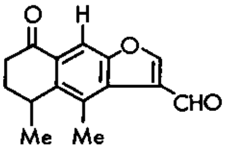
(-)-VITERALONE FROM *VITEX ROTUNDIFOLIA* L.

Haruhiko Tada* and Fumio Yasuda
Shionogi Research Laboratories, Shionogi & Co., Ltd.,
Fukushima-ku, Osaka 553, Japan

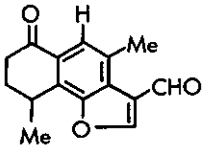
Abstract — A benzofuran derivative (-)-viteralone (1) was isolated from *Vitex rotundifolia* L. in a phytochemical survey of Japanese medicinal plants. The structure of 1 was mainly elucidated by spectroscopy and confirmed by x-ray analysis.

Vitex rotundifolia L. has long been used as a medicinal plant in Japan and several compounds have hitherto been isolated from it; flavonols[1] (from the fruits), iridoid glucosides[2] (from the leaves) and diterpenes[3] (from the leaves). This report describes the structure of a minor component (-)-viteralone (1), isolated from the creeping stem.

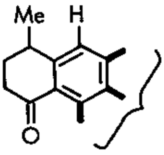
The dichloromethane extract of the plant material (1.8 kg) was chromatographed on silica gel (Merck Lobar B), and following preparative TLC afforded taraxerol, lupeol and a sesquiterpene 1 (42 mg): mp 153-154 °C, $[\alpha]_D$ -3.4° (c 0.4, $CHCl_3$). Elementary analysis and EI-MS (M^+ 242) gave the molecular formula $C_{15}H_{14}O_3$. Ir (ν, $CHCl_3$, cm^{-1}), 1695 (CO), 1685 (CHO), 1620 and 1557 (arom.); uv (λ, EtOH nm), 215 (ε, 18600), 275 (ε, 17500); cd ($[\theta]_{nm}$ MeOH), 383 (0), 338 (+15200), 316 (0), 300 (-9100), 275 (-4300), 260 (-5300), 245 (-3600), 217 (-24100), 205 (0). Consideration of the above data and ^1H-nmr, ^{13}C-nmr and n.o.e. experiment (see Fig. 1) showed 1 to be a tricyclic compound including benzofuran. There are two possible formulae (A) and (B) for the construction of the three rings. An alternative alignment of the cyclohexanone ring (C) can be ruled out since the



(A)



(B)

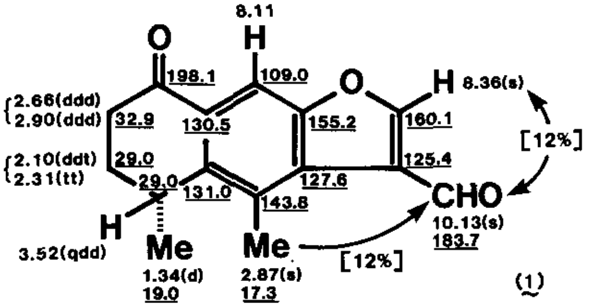


(C)

aromatic proton appears at low field (δ 8.11) due to an anisotropic effect of the carbonyl group.

Although long range coupling between the aromatic proton and the aromatic methyl group was revealed by a double resonance experiment, whether the situation is *ortho* or *para* (both $^{4}J_{\underline{ortho}}$ and $^{6}J_{\underline{para}}$ 0.6 Hz)[4] could not be determined. In the ^{1}H-gated decoupling (with n.o.e.) ^{13}C-nmr spectrum of 1, the signal of the aromatic methyl appeared as a sharp quartet indicating the absence of long range coupling with the aromatic proton, thus showing the existence of the *para* situation.[5] The relative configuration of C_4-Me must be *quasi*-axial [J values of C_4-H (qdd) are 7.0, 5.0 and 2.5 Hz] and the absolute configuration was determined as *R* according to the cd data ($[\theta]_{338}$ +15200).[6]

While this study was in progress, Vishnoi *et al.*[7] proposed the same planar structure for an elemophilane derivative isolated from *Vitex negundo*. However, they did not unambiguously rule out bent form alignment (B), and no evidence was given for determination of the absolute configuration of C_4-Me. Since the ^{1}H-nmr spectrum (200 MHz) of our sample was identical with that of Vishnoi *et al.*, 1 must be the antipode of their compound [mp 146 °C, $[\alpha]_D$ +6.4° (c 1, $CHCl_3$)]. The structure of 1 was finally confirmed by x-ray analysis (Fig. 2). The ring alignment was strictly shown to be the linear type (A) and the aromatic proton and the methyl group were determined to be *para* to each other.



(1)

Fig. 1. ^{1}H-nmr (200 MHz $CDCl_3$), ^{13}C-nmr (25.2 MHz $CDCl_3$; underlined) and n.o.e. (observed; in brackets).

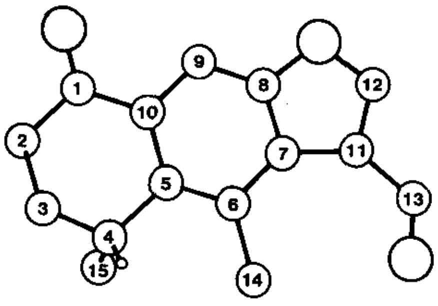


Fig. 2. Perspective view of 1.

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