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SYNTHESIS AND CRYSTAL STRUCTURE OF DECAHYDRO-DISPIRO[OXIRANE-2,3'-(2'H)BENZOFURAN-2',2"-[2H]PYRAN]

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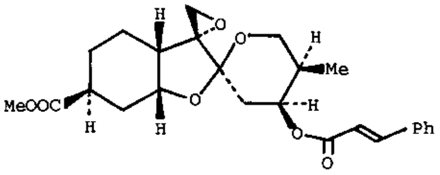
Abstract ——(2'S*,3'R*,3'aS*,7'aR*)-Decahydro-dispiro[oxirane-2,3'(2'H)benzofuran-2',2"-[2H]pyran] (E-6) and its isomer E-6' with epimeric stereochemistry of the epoxide ring were prepared stereoselectively and an X-ray analysis of E-6' is reported.

In the preceding paper,[1] we described an efficient route of E- and Z-1,6-dioxaspiro-[4.5]decane ring systems, important moieties of many natural products including insect pheromones and polyether antibiotics.

In this paper, we report the synthesis of dispiro compounds, E-6 and its isomer E-6', the essential framework of phyllanthocin 1[2], and an X-ray analysis of E-6' which confirms the correctness of our previous proposal about the stereochemistry of a series of compounds 2, 3, 4 and 5.

Though various attempts[3] to introduce the epoxy function into the E-olefin 4 were unsuccessful, resulting in recovery of the starting material or decomposition, epoxidation in conventional way(MCPBA, CH_2Cl_2, 0°C, 48 h) afforded the two diastereomeric isomers, E-6[the minor isomer(5.6%); bp 100°C/0.01 mmHg; $\delta_H(CCl_4)$: 2.68 and 2.76(each 1H, d, J=5 Hz), 3.30-3.58(1H, m), 3.62-3.89(1H, m), 4.15(1H, m); $\delta_C(CDCl_3)$: 38.8(d), 61.8(t), 70.2(s), 73.5(d), 103.2(s)] and E-6'[the major isomer(84%); mp 57.5-58°C; $\delta_H(CCl_4)$: 2.58 and 2.62(each 1H, d, J=5 Hz), 3.40-3.98(2H, m), 4.23(1H, m); $\delta_C(CDCl_3)$: 40.5(d), 61.9(t), 70.5(s), 73.0(d), 100.7(s)].

On the other hand, this minor isomer E-6 was derived from E-ketone 5 with high selectivity in a two-step sequence(46% overall yield): the formation of β-hydroxysulfide E-7[$PhSCH_2Li$[4](5 equiv.), THF, r.t., 15 h] and methylation at the sulfur with



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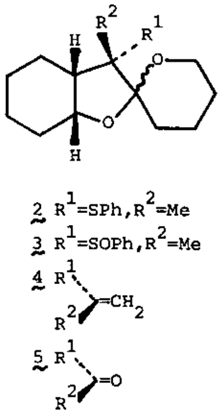
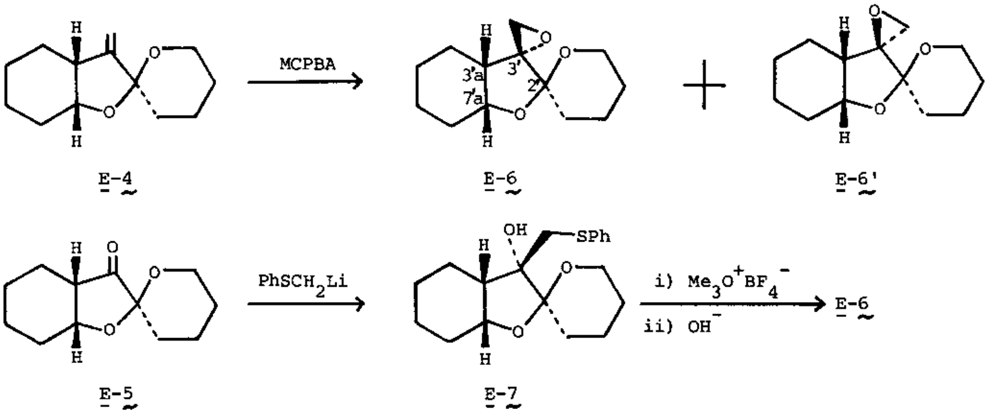


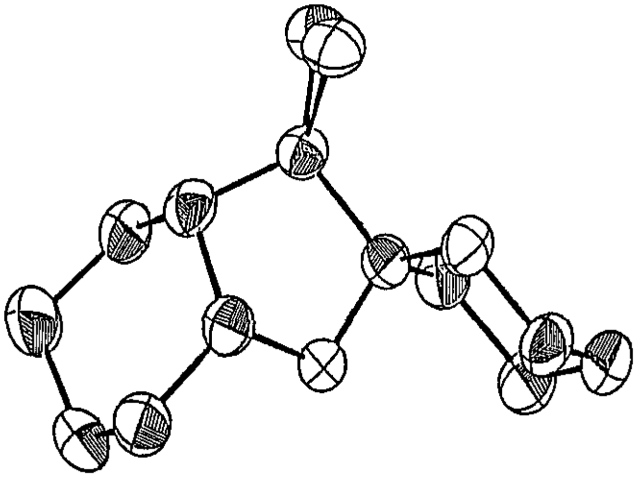
2 R^1=SPh,R^2=Me
3 R^1=SOPh,R^2=Me
4
5

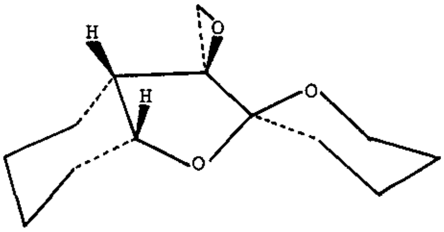


trimethyloxonium tetrafluoroborate(CH_2Cl_2, r.t., 1 h) followed by treatment of aq. base(5% NaOH, r.t., 15 h).[5]

An attempt to determine the stereochemistry of these isomers by the NMR spectra was uninformative. Thus, in order to establish these structures and ensure our previous stereochemical assignments of a series of the synthetic intermediates 2, 3, 4 and 5 based on the ^{13}C NMR spectral data, the nicely crystalline compound E-6' was subjected to an X-ray analysis. The crystal data and intensity data were derived from the measurements on a Syntex R3 four-circle diffractometer with graphite-monochromated MoKα radiation. Crystal data: $C_{13}H_{20}O_3$, monoclinic, space group $P2_1/c$, a=11.770(4), b=9.573(4), c=10.769(7)Å, β=92.01(4)°, Dx=1.23 $g.cm^{-3}$, z=4 and μ(MoKα)= 0.9 cm^{-1}. Intensity data for 1293 reflections($I > 1.96\sigma(I)$) were collected using an ω-scan mode within 2θ less than 45°. Lorentz and polarization corrections were applied, but no absorption corrections were made. The structure was solved by the direct method using MULTAN on a Syntex XTL program. All the hydrogen atoms were found on a difference Fourier map. The refinement of atomic parameters was carried out by block-diagonal least-squares calculations. The final R-value was 0.041 assuming anisotropic thermal motions for non-hydrogen atoms and isotropic ones for hydrogen atoms. The molecular structure is illustrated in Figure. Once the structure of E-**6**' was established, the structures of the synthetic intermediates **2**, **3**, **4** and **5** then logically followed.

In conclusion, we have achieved a stereoselective synthesis of dispiro compound E-**6** which possesses the requisite stereochemistry among the tetracyclic rings contained in phyllanthocin **1**. Further synthetic approach toward phyllanthocin and related compounds is in progress.





E-**6**'

Figure. The molècular structure of E-**6**'

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