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A STEREOSELECTIVE SYNTHESIS OF (±) ACORENONE-B.

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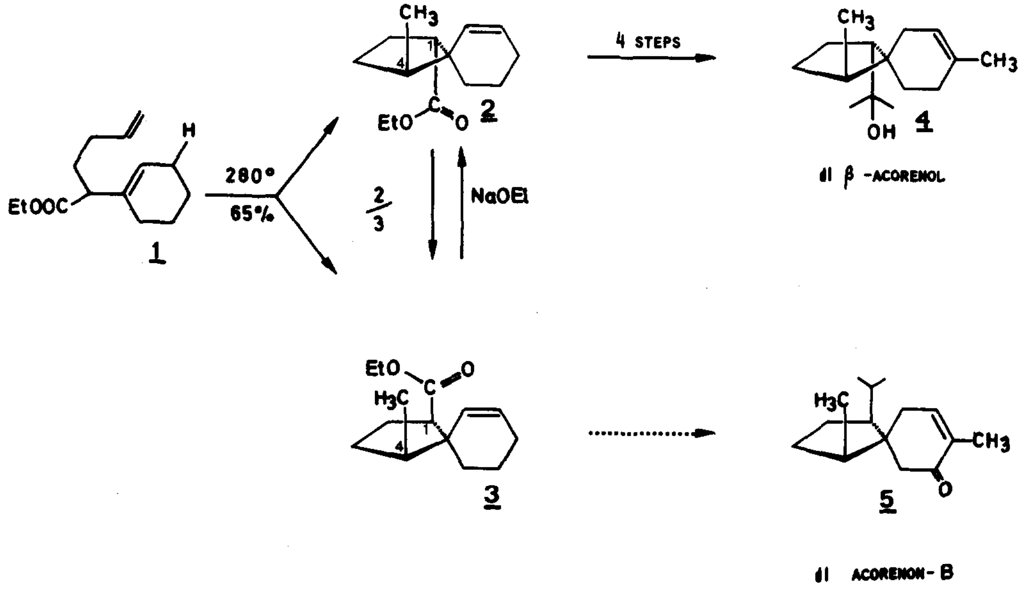
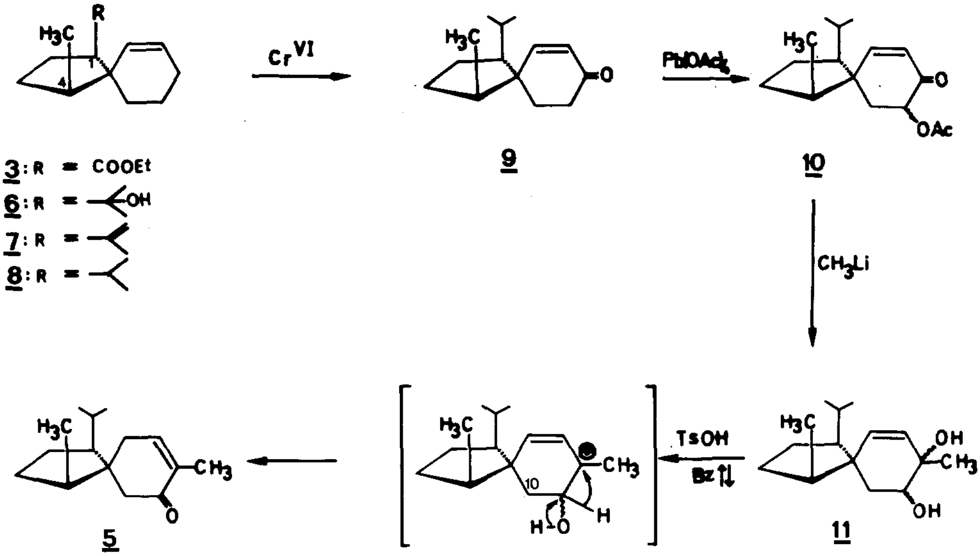
The spirocyclic sesquiterpene acorenone-B, isolated from Bothriochloa intermedia, has been assigned structure 5 on the basis of chemical, spectroscopic and X-ray evidence$^{1)}$, and its first synthesis by a partially stereoselective route has been reported recently$^{2)}$.
We wish to present an alternative synthesis of racemic acorenone-B 5, which exploits recent observations on the stereoselectivity of kinetically controlled intramolecular ene-reactions$^{3)}$.



Thus, thermal cyclisation of the 1,6-diene 1 furnished a separable mixture (1:1) of the esters 2 and 3 in 65% yield4). No further stereoisomers could be detected in the reaction mixture by glc5) ; so the cis-relationship of the methyl and vinyl group is achieved in 2 and 3 with 100% stereoselectivity. Base catalyzed interconversion4) of the esters 2 and 3 provides an easy access to either 1,4-cis- or 1,4-trans-substituted spiro[4,5]decane derivatives. Thus, (±)β-acorenol 4 has been synthesized from the 1,4-trans-ester 2 in four steps4).



(±) Acorenone-B 5 in view, the ester 3 was treated with an excess of methyllithium in ether at 25° for 40 min. followed by regioselective dehydration of the crude isopropanol 6 (ir(film) 3500 - 3440 cm^{-1}, 99% yield) with Al_2O_3/ pyridine at 220° for 9h6) to give the isopropenyl-spirodecene 7 7) 8) (dist. 80° (bath)/ 11 Torr, ir (film): 1640, 890, 730, 700 cm^{-1}, 96% yield), which on selective hydrogenation with chlorotris(triphenylphosphine)rhodium in benzene9) gave the isopropyl spirodecene 8 7) (dist. 80°(bath)/ 12 Torr, ir (film): 730, 700 cm^{-1}, 99% yield). Subsequent allylic oxidation10) with sodium chromate in acetic acid/acetic anhydride furnished the cyclohexenone 9$^{7)}$ $^{8)}$ (dist. 80^{o} (bath)/ 0,3 Torr, ir (film): 1685, 1617 cm^{-1}, uv (MeOH)λ_{max}: 238nm (logε= 4.0), 318nm (logε= 1.74), 68% yield).

α-Acetoxylation of the cyclohexenone 9 with lead tetraacetate$^{11)}$ afforded an epimeric mixture of acetates 10$^{7)}$ (ir(film): 1750, 1705, 1620 cm^{-1}, 75% yield), which on addition of an excess of methyllithium at -70^{o}C, followed by slow warming up to room temperature gave the stereoisomeric diols 11 (ir(film): 3500 - 3440 cm^{-1}, 85% yield). Finally, dehydration of the diol mixture 11 with a 5% solution of toluenesulfonic acid in boiling benzene for 1h gave (±) acorenone-B 5 (57% yield), which exhibits the same ir-, ^{1}H-nmr- (100 MHz), mass-spectra and identical chromatographic behaviour (tlc and glc$^{12)}$) as an authentic sample of (±) acorenone-B.

The transformation 11 ⟶ 5 presumably involves a pinacol-type hydrogen shift, followed by migration of the olefinic bond$^{13)}$. To our knowledge this 3-step 1,2 enone transposition ($9 \longrightarrow 10 \longrightarrow 11 \longrightarrow 5$) has not been described previously, despite its apparent simplicity$^{14)}$. Its scope and limitations are currently under investigation.

We are indebted to Professor H. Wolf for the spectra and a sample of (±) acorenone-B. We also wish to record our gratitude to the Fonds National Suisse de la Recherche Scientifique, the Sandoz Ltd, Basel and the Givaudan SA, Vernier for generous financial support of this work. One of us (K.K.M.) wishes to thank the Jadavpur University, Calcutta, for a sabbatical leave.

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5) Apart from the compounds **6** and **11** the purity of all intermediates was checked by glc using a 150 ft capillary column SE-30 at 150° to 175°.

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7) The ir- ^{1}H-nmr- and mass spectra are in agreement with the assigned structure.

8) Elemental analytical data in excellent accord with theory were obtained for this substance.

9) Under these conditions the endocyclic double bond is inert; this may be attributed to its steric shielding by the substituents at C-1 and C-4.

10) J.A. Marshall and P.C. Johnson, J. org. Chemistry **35**, 192 (1970).

11) T. Sone, S. Terashima and S. Yamada, Synthesis, **10**, 725 (1974).

12) 3m/3mm-glass column packed with 5% OV-225 on chromosorb W/200° C.

13) The crude reaction mixture, obtained from the diols **11**, contains no aldehyde (^{1}H-NMR), which militates against migration of C-10 during the reaction.

14) For the conversion of 2-cyclohexenones to 5-cyclohexenones via acetoxyketones see Ref. 11. For 1,2-carbonyl-transpositions of saturated ketones see: J.E. Bridgeman, C.E. Butchers, Sir Ewart R.H. Jones, A. Kasal, G.D. Meakins, and P.D. Woodgate, J. Chem. Soc. **1970**, 244 and references cited therein; J.K. Barieux and J. Gore, Bull. Soc. Chim. **1971**, 1649; K. Grychtol, H. Musso and J.F.M. Oth, Chem. Ber. **105**, 1798 (1972); B.M. Trost K. Hiroi and S. Kurozumi, J. Amer. Chem. Soc., **97**, 438 (1975).