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A ONE-STEP SYNTHESIS OF THE TWISTANE RING SYSTEM

8-ACETOXY-4-TWISTANONE

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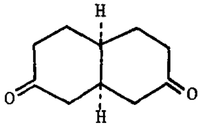
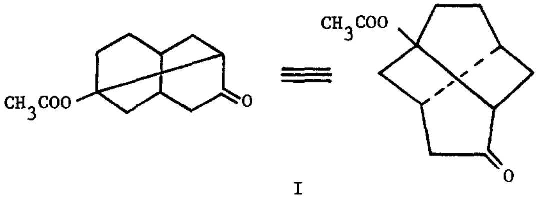
The first synthesis of twistane (tricyclo$[4.4.0.0.^{3.8}]$decane) was achieved by Whitlock[1] in 1962. We have recently succeded a much shorter synthesis of this hydrocarbon by a different method[2]. We wish now to communicate a one-step synthesis of 8-acetoxy-4-twistanone (I).

Treatment of the readily available diketone II[2,3] with a mixture of acetic acid, acetic anhydride and boron trifluoride etherate at room temperature gave 8-acetoxy-4-twistanone (I)** in 75% yield. [m.p. 66-68°C; m.w. (mass spec.) 208; λ max (CCl_4) 1725 and 1245 cm^{-1}; τ ($CDCl_3$) 7.32 (IH, broad doublet, CHCO) and 8.05 p.p.m. (3H, singlet, CH_3COO); 2,4-dinitrophenylhydrazone, m.p. 184-185°C].



II



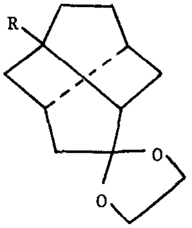
I

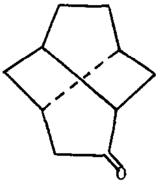
III $R = CH_3COO$

IV $R = OH$

V $R = Br$

VI $R = H$





VII

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** All new compounds gave satisfactory elemental analyses.

A complete proof of structure has been obtained by the transformation of compound I into the known 4-twistanone (VII)[2].

Ketalisation of compound I with ethylene glycol, benzene and p-toluenesulfonic acid gave ketal acetate III. [m.w. (mass spec.) 252; λ max (CCl_4) 1725 and 1245 cm^{-1}; τ ($CDCl_3$) 6.14 (4H, multiplet, OCH_2CH_2O) and 8.03 p.p.m. (3H, singlet, CH_3COO)]. Reductive hydrolysis of ketal acetate III with lithium aluminium hydride in ether yielded ketal alcohol IV [m.w. (mass spec.) 210; λ max (CCl_4) 3590 cm^{-1}; τ ($CDCl_3$) 5.96 (4H, multiplet, OCH_2CH_2O) and 7.90 p.p.m. (IH, singlet, OH)] which was transformed into bromo ketal V [m.w. (mass spec.) 272 and 274; τ (CCl_4) 6.08 p.p.m. (4H, multiplet, OCH_2CH_2O)] by treatment with thionyl bromide in pyridine[4].

Hydrogenolysis of bromo ketal V with Raney nickel in methanol containing sodium hydroxide [4] gave ketal VI. [m.w. (mass spec.) 194; τ (CCl_4) 6.22 p.p.m. (4H, multiplet,OCH_2CH_2O)] which yielded after acid hydrolysis, a crystalline ketone having its physical (m.p. and t.l.c.) and spectral properties (infrared and n.m.r.) in complete agreement with those of 4-twistanone (VII)[2].

Since 4-twistanone (VII) has already been converted to twistane [2], this work constitutes a third synthesis of the hydrocarbon.

8-acetoxy-4-twistanone (I) is the first twistane derivative having a functional group at a bridgehead position. Its simple synthesis opens the way for the preparation of interesting unknown compounds like 1-twistanol and 1-twistane carboxylic acid. Furthermore, it should be an excellent starting material for the synthesis of 1-twistanamine, the skeletal isomer of the important antiviral agent, 1-adamantanamine hydrochloride [5].

Experiments in this direction are now in progress.

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