Tetrahedron Letters No. 51, pp 4539 - 4540, 1977. Pergamon Press. Printed in Great Britain.

SPIROCYCLIC SYNTHESIS BY [4+2]-CYCLOADDITION: THE PREPARATION OF 11,13-DIOXA-1,4-DITHIA-12,12,18-TRIMETHYL-10,14,17-TRIOXOTRISPIRO[4.2.0.5.4.2]EICOSANE

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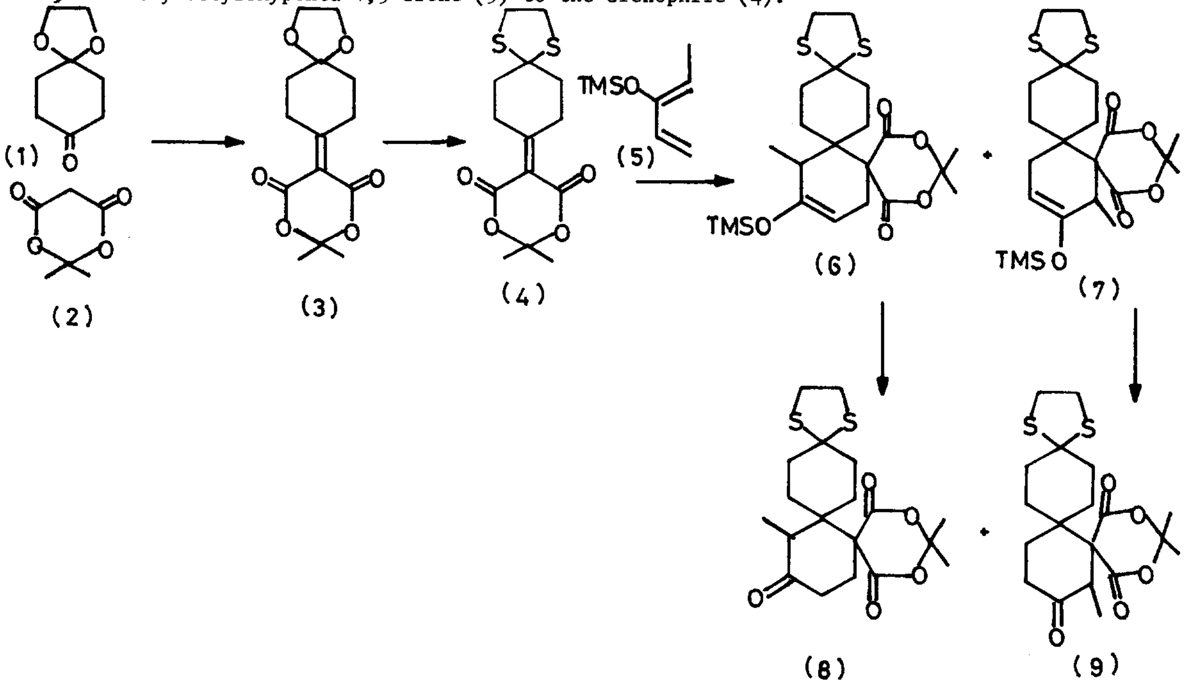
(Received in UK 14 October 1977; accepted for publication 27 October 1977)

In connection with a proposed tetracyclic diterpenoid synthesis we required a route to the title compound (8). We now report a simple and efficient synthesis of (8) by the cycloaddition of 3-trimethylsilyloxypenta-1,3-diene (5) to the dienophile (4).[1]



Knoevenagel condensation[1] of the readily available monoacetal (1)[2] with isopropylidene malonate (2) gave the cyclohexylidene derivative (3), m.p. 155-157°C, in 59% yield, and this was converted in 82% yield (ethanedithiol and hydrogen chloride in chloroform at room temperature) into the thioacetal (4), m.p. 147-149°C.

The reaction of (5)[4] with the dienophile (4) could give two possible regioisomers, *viz.* (6), which should be favoured by the presence of the 3-trimethylsilyloxy group in (5),[5] and (7), which should be favoured by the 4-methyl substituent in (5).[1] In practice the reaction (two-fold excess of diene, boiling chloroform, 4.5 days) gave (72%) a mixture of (6) and (7) which was hydrolysed[6] to a 3:2 mixture of the ketones (8) and (9). These were separated by short column chromatography on silica, followed by elution with a mixture of chloroform, petrol b.p. 60-80°C, and methanol (15:85:7). Although no simple chemical or spectroscopic method was found to distinguish (8) from (9), a single crystal X-ray analysis of the first eluted, more abundant [44% from (4)] ketone, m.p. 168-170°C, [δ (CDCl$_3$) 1.23, (C-18 methyl)] showed that it possessed structure (8).[7] The ketone (7) crystallised as monoclinic crystals, space group $P2_1/c$, a = 9.498(3), b = 21.076(6), c = 9.621(2) Å, β = 95.75(3)°, U = 1916.2 Å^3, D_x = 1.380 g cm^{-3}, Z = 4, μ = 26.18 cm^{-1}. The structure was refined to an R of 0.082 for 2039 unique reflexions.

The less abundant [28% from (4)] ketone, m.p. 174-176°C [δ [CDCl$_3$) 1.08 (C-15 methyl)] was assigned structure (9).

We thank Dr. P.G. Jones for carrying out the X-ray analysis and the S.R.C. for financial support.

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