Tetrahedron Letters No. 12, pp 1009 - 1010, 1974. Pergamon Press. Printed in Great Britain.

A SYNTHESIS OF 4,6-DIEN-3-ONES IN THE BICYCLO[4.4.0]DECANE SERIES

A.J. Birch and K.P. Dastur

Research School of Chemistry, Australian National University

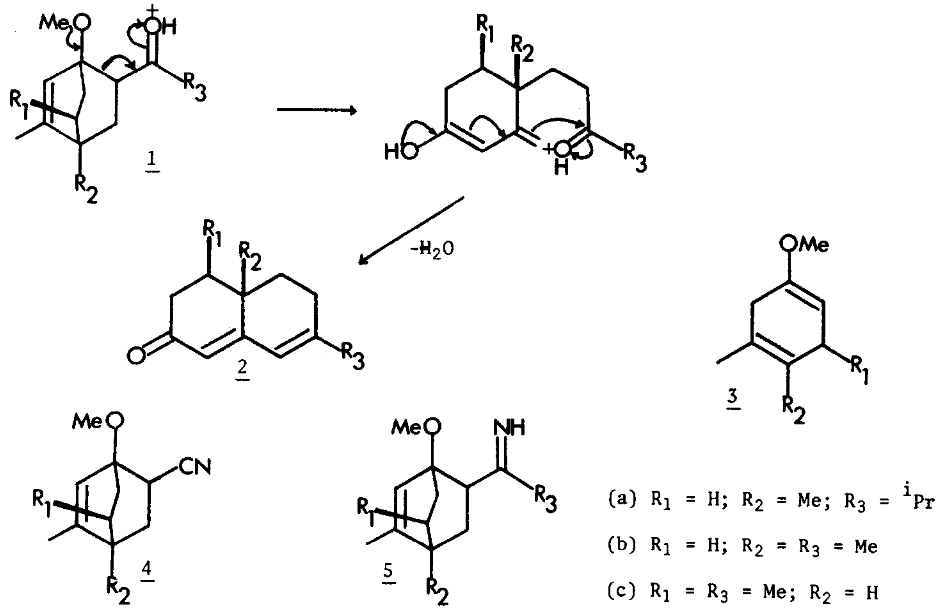
P.O. Box 4, Canberra ACT 2600

(Received in UK 22 January 1974; accepted for publication 8 February 1974)

The structures of a number of sesquiterpenes are based on the bicyclo[4.4.0]decane system, which in the past has frequently been elaborated by Robinson annelation.[1,2] In this process, reaction of an αβ-unsaturated ketone can occur with one or both enolates of an unsymmetrical ketone,[1] often uncontrollably. Moreover, since the products are ketones, further reactions can occur and yields may be poor.

An alternative procedure to usefully functionalised bicyclo[4.4.0]decane derivatives has now been found in the acid-catalysed transformation[3] of 1-methoxybicyclo[2.2.2]octane derivatives of type 1, giving finally dienones of type 2.

Scheme*



(a) R_1 = H; R_2 = Me; R_3 = ${}^{i}Pr$

(b) R_1 = H; R_2 = R_3 = Me

(c) R_1 = R_3 = Me; R_2 = H

*Compounds 1, 2, 3, and 4 have satisfactory spectral data.

The bicyclo-ketones of type 1 can be prepared from dihydroanisole derivatives such as 3 obtained by Birch reduction of aromatic precursors. A limitation on 3 is that if it is unsymmetrical in the sense that $R_1 \neq$ Me or H, mixtures are liable to be obtained in the reduction.

In situ Diels-Alder reaction of 3 with acrylonitrile[4] gives rise to an adduct of the type 4(∿75%), which when stirred in ether for 20 hr at room temperature under nitrogen with 4 equivalents of an alkyl lithium LiR_3, affords the imine 5. Column chromatography of the latter compound on silica with chloroform as eluent gives the pure ketone 1 in 60-70% yield from 4.

Conversion of 1 into the dienone 2 was accomplished by stirring it in dichloromethane for 3 hr at room temperature with a catalytic quantity of boron tribromide. Yields of pure chromatographed 2 (silica/chloroform) thus obtained were of the order of 85%.

Several salient features of the present route may be noted. R_1,R_2,R_3 can be varied, with the qualifications mentioned above, by choice of the particular diene and of the alkyl lithium. From the nature of the Diels-Alder transition state it would be expected, and in one example where R_1,R_2 = Me has been proved,[5] that R_1 and R_2 should be orientated so that they are finally cis-disposed in 2, a relationship otherwise difficult to achieve. The reductive methylation of compounds prepared by this route has already been briefly reported.[6]

We thank L.L. Welling, Esq., for technical assistance.

References

1. A.Van Der Gen, L.M. Van Der Linde, J.G. Witeveen and H. Boelens, Rec.Trav.Chim.Pays-Bas, 90, 1034 (1971).
2. E. Piers and R.J. Keziere, Tetrahedron Letters, 583 (1968); R. Howe and F.C. McQuillin, J.Chem.Soc., 2423 (1955); W.G. Dauben and A.C. Ashcraft, J.Amer.Chem.Soc., 85, 3673 (1963).
3. The ring-opening of such bicyclo-ketones has already been studied [e.g. A.J. Birch and J.S. Hill, J.Chem.Soc.(C), 419 (1966)], but it is the olefinic methyl group of 1 that is essential for occurrence of the present sequence.
4. A.J. Birch and K.P. Dastur, J.C.S.Perkin I, 1650 (1973), and references therein.
5. K.P. Dastur, J.Amer.Chem.Soc., 95, 6509 (1973).
6. K.P. Dastur, Tetrahedron Letters, 4333 (1973).