Transformation of α-Santonin into the Germacranolide Dihydronovanin

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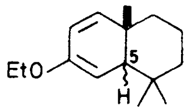
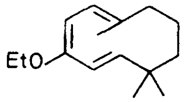
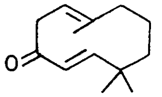


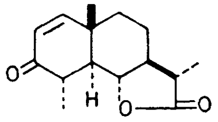
(I) 5α-H
(II) 5β-H



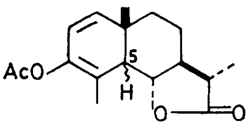
(III)



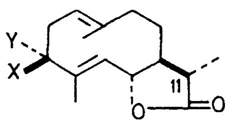
(IV)



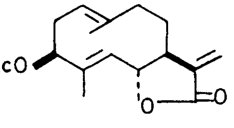
(V)



(VI) 5α-H
(VII) 5β-H



(VIII) X, Y = O
(IX) X = OH, Y = H
(X) X = H, Y = OH
(XI) X = OAc, Y = H



(XII)

Summary The enol acetate (VI), derived from α-santonin, was irradiated and hydrolysed to give the cyclodecadienone (VIII), which yielded dihydronovanin (XI) upon reduction followed by acetylation.

It has been found that on irradiation the *trans*-hexahydronaphthalene (I) gives a photostationary equilibrium mixture with the *cis*-isomer[1] (II). Since the possible intermediate (III) of the equilibrium involves an enol-ether double bond, the cyclodecadienone (IV) could be obtained if the intermediate is hydrolysed before recyclisation. However, such attempts to obtain the cyclodecadienone[2] were unsuccessful.

The dihydro-α-santonin[3] (V) was heated with isopropenyl acetate in the presence of toluene-*p*-sulphonic acid giving the enol acetate† (VI), λ_{max} (MeOH) 262 nm (ϵ 4500). Irradiation of (VI) in methanol with a low-pressure mercury lamp at −40 to −20°, followed by work-up at room temperature, afforded a mixture of (VI) and the *cis*-isomer (VII), m.p. 98·5—100·5°, λ_{max} (MeOH) 263 nm (ϵ 4450), in the ratio of 2—3 : 1 after equilibration. On the other hand, treatment of the irradiated solution with potassium hydroxide at −40 to −20° gave a mixture of products, from which the dienone (VIII), m.p. 119—120°, was isolated by silver nitrate–silica gel chromatography. Sodium borohydride reduction of (VIII) proceeded stereoselectively, and the resulting amorphous alcohol (IX) yielded the acetate (XI), m.p. 133·5—134°, upon acetylation with acetic anhydride–pyridine in 8% yield based on the enol ester (VI). The alcohol (IX) was not identical with tamaulpin B[4] (X), while the acetate (XI) was shown, by spectral comparison,‡ to be dihydronovanin, the sodium borohydride reduction product of novanin[5] (XII).

We thank Professors T. A. Geismann and T. J. Mabry and Dr. N. Nakatani for the identification of dihydronovanin.

(*Received, 30th March* 1972; *Com.* 547.)

† All new compounds described had the expected spectra and gave satisfactory elemental analyses.

‡ According to Professor Geismann, this identification confirmed the stereochemistry of the C-11 methyl group of dihydronovanin.

[1] M. Miyashita, H. Uda, and A. Yoshikoshi, *Chem. Comm.*, 1969, 1396.

[2] This compound has been prepared by another route, M. Miyashita and A. Yoshikoshi, *Chem. Comm.*, 1971, 1091.

[3] E. J. Corey and A. G. Hortmann, *J. Amer. Chem. Soc.*, 1965, **87**, 5736.

[4] N. H. Fischer and T. J. Mabry, *Chem. Comm.*, 1967, 1235; H. Yoshioka, W. Renold, N. H. Fischer, A. Higo, and T. J. Mabry, *Phytochemistry*, 1970, **9**, 823.

[5] T. A. Geismann, personal communication.