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FORMATION OF 2-KETO-α-CYPERONE BY OXIDATION AND REARRANGEMENT OF 3-HYDROXYSOLAVETIVONE

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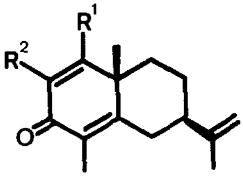
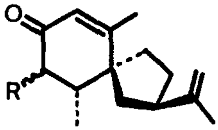
Abstract: Mild oxidation of the tobacco sesquiterpenoid, 3-hydroxysolavetivone, gives the corresponding α-diketone which undergoes a facile thermal rearrangement to 2-keto-α-cyperone.

In 1972 Roberts[1] reported the isolation of a sesquiterpenoid from burley and flue-cured tobaccos to which structure (1) was ascribed. Since that time several nor-eudesmane and spirovetivane sesquiterpenoids have been isolated from Nicotiana species in response to various stress factors,[2] and, in more general terms, the Solanaceae family has provided a rich array of phytoalexins. As part of the extensive studies in this area by Murai et al.[3] a structural revision of (1) to 2-keto-α-cyperone (2) was necessitated on the basis of spectroscopic and synthetic evidence.

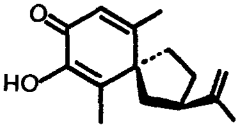
In the course of our own investigations, the epimeric 3-hydroxysolavetivones (3), synthesised from (-)-solavetivone (4),[4] were oxidised with cupric acetate in refluxing methanol. 2-Keto-α-cyperone (2) was obtained in essentially quantitative yield and its identity was established by the usual means.[5] On the other hand, oxidation of (3) with basic ferric chloride[6] yielded a 3:1 mixture of (2) and the diketone (5),[7] which was readily converted into (2) in refluxing methanol. Since both solavetivone (4) and its hydroxy derivatives (3) (as the free aglycones[8] and the β-glucosides[4]) are known aromaful tobacco constituents, the facile oxidation (enzymatic ?) and thermal rearrangement is the most likely pathway to (2). It is



(1) R^1=OH, R^2=H
(2) R^1=H, R^2=OH



(3) R =OH
(4) R =H



(5)

interesting to note that, in a purely biosynthetic sense, Murai et al.[9] have clearly demonstrated that solavetivone (4) is the precursor of rishitin (6), a stress metabolite of infected potatoes, by way of lubimin (7) and oxylubimin (8).

In principle, the thermal rearrangement of (5) could yield two products, namely (2) and (9) as illustrated. We suggest that migration (i) will be preferred since the alternative migration (ii) places the C-10 methyl and C-8 isopropenyl groups in a 1,3-diaxial configuration.[10]

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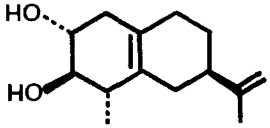
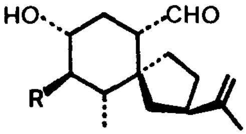
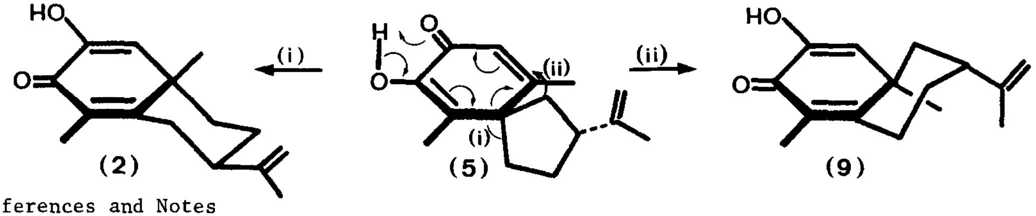


(6)



(7) R = H

(8) R = OH



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5. m.p., α_D, i.r., n.m.r., u.v. and mass spectra were all in accord with the published data. We thank Dr. A. Murai for the comparison spectra.
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7. $\lambda_{max.}$(EtOH) 275nm (ε, 15,500); $\nu_{max.}$ 3500, 1660 and 1620 cm^{-1}; $\delta(CCl_4)$ 1.78 (3H,s), 1.98 (3H,s), 2.07 (3H,s), 4.72 (2H,bs), 6.01 (1H,s), and 6.23 (1H,s,OH).
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10. Cf. D. Caine, C-Y. Chu and S.L. Graham, J.Org.Chem., 45, 3790 (1980).

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