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PHOTOLYSIS OF 11-NITRITE ESTERS OF VERATROBASINE (1)

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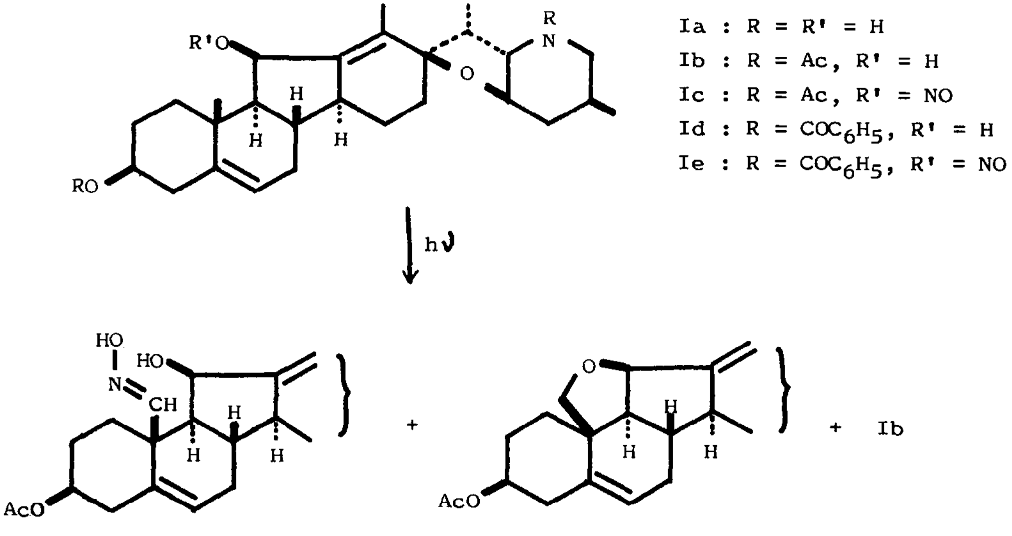
We have recently reported the results of irradiation of some fused cyclopentyl nitrites which were derived from jervine (2).

We now describe the results of the photolysis of veratrobasine 11-nitrites (jervine-11β-ol 11-nitrites) (Ic and Ie) (3). The mode of light-induced transformation of these nitrites is of interest in view of the recent establishment of the conformation of veratrobasine (Ia) by X ray diffraction study (3) as well as a variety of reactions observed in nitrites on five-membered rings (4).

Thus, the reaction of 3-O,N-diacetylveratrobasine (Ib) (5) with nitrosyl chloride in pyridine afforded the corresponding stable nitrite (Ic), m.p. 169-170° (decomp.). This (1.65 g) was photolyzed in toluene (40 ml) by a 150 W high pressure mercury arc lamp for 40 minutes at 15°, yielding 3-O,N-diacetylveratrobasine (Ib) (190 mg in the crude form), and three new compounds. One of these, II, m.p. 221-223° (14%) was the major product of the reaction and was analyzed for a molecular formula $C_{31}H_{44}O_6N_2$. The n.m.r. and i.r. spectra allowed us to formulate this as 19-oximino derivative of 3-O,N-diacetylveratrobasine, (II). Of the other two minor compounds, the compound III, m.p. 210-216° (1%), had a molecular formula $C_{31}H_{43}O_5N$ and showed M^+ peak at 509 in the mass spectrum. The n.m.r. spectrum of this revealed C-18 methyl protons at τ 8.07, N-acetyl at τ 7.92 or τ7.85, O-acetyl at τ7.85 or τ7.92, C-6 proton at τ 4.40 and C-11 proton at τ 5.13 (doublet, J=3.9). However, a singlet due to C-19 methyl protons in Ib was absent in the spectrum. Thus, the structure (III) would be assignable to this substance.

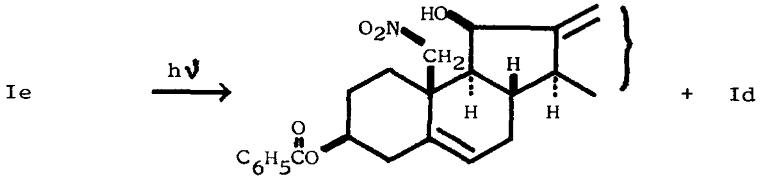
Similar transformation to afford cyclic ether during nitrite photolysis has been reported in the field of normal steroids (6).



Ia : R = R' = H
Ib : R = Ac, R' = H
Ic : R = Ac, R' = NO
Id : R = COC_6H_5, R' = H
Ie : R = COC_6H_5, R' = NO

II

III



IV

The photolysis of 3-O,N-dibenzoylveratrobasine 11-nitrite (Ie), m.p. 156-163°, (214 mg), which was prepared by partial benzoylation of veratrobasine followed by nitrosation, was carried out under comparative condition. The reaction in this case led to afford four compounds, i.e., 3-O,N-dibenzoylveratrobasine (Id), m.p. 238-241° (4%), the compound IV, $C_{41}H_{48}O_7N_2$, m.p. 165-170° (11%), the product A, m.p. 264-269° (2 mg) and the product B, m.p. 179-182° (19 mg). The n.m.r. spectrum of IV lacked a singlet due to 19-methyl protons which was distinctive in Ia. The i.r. spectrum of IV revealed strong bands at 1518 cm^{-1} and 1378 cm^{-1} which suggested the presence of NO_2 group in the molecule. These and other evidence indicated the compound IV should be formulated as 19-nitro-3-O,N-dibenzoylveratrobasine (IV).

Although a number of results of the photolysis dealing with nitrite ester of cyclopentanol derivatives has been reported (4) the result of photolysis of Ic seems to be the first example in which the Barton reaction was the major course of the reaction of cyclopentyl nitrite without accompanying appreciable cleavage of five-membered ring or epimerization of the relevant alkoxyl radical (4). The formation of the primary nitro-compound (IV) in photolysis of Ie is unusual and must have arisen from the intermediary nitroso-compound by the oxidation with a trace of oxygen before the rearrangement to the oximino-compound had taken place (7). Moreover, it should be mentioned that formation of 11-keto compounds, which may arise from either α-hydrogen fission or disproportionation, was not observed in the present case.

The reactions may serve for syntheses of a variety of 19-nor-derivatives and for modification of A-ring of these molecules.

Experiment with N-acetyl-22,27-imino-17β,23β-oxidojerv-4,12-diene-11β-ol-3-one 11-nitrite (Δ^4-3-ketone corresponding to Ic) is in progress to obtain further knowledge of the reaction described.

Acknowledgement

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References and Footnotes

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(7) The problems of whether the oxidation is induced by light and whether the reaction is peculiar to benzoates are not clear and clarification of these is being pursued.