Photochemical Synthesis of Protoberberine Alkaloids

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RECENTLY, photochemical reactions have been used in the synthesis of a number of alkaloid systems.[1] We now report a ready synthesis of protoberberinium salts in good yield from 2-acetyl-1-benzylidene-1,2,3,4-tetrahydroisoquinoline derivatives.

Irradiation of 2-acetyl-1-benzylidene-1,2,3,4-tetrahydroisoquinoline (I), m.p. 118—119°, in methanol with an equimolar amount of iodine gave,† in 42% yield, a yellow crystalline solid, which is soluble in water with an intense blue fluorescence, lacked carbonyl absorption in the infrared, and possessed an ultraviolet spectrum different from the dehydroaporphane system[1a] [λ_{max}(EtOH) 265 mμ (log ϵ 4·28), 302 mμ (4·06), 313 mμ (4·13) and 368 mμ (3·84)]. Elemental analysis indicated a molecular formula of $C_{18}H_{16}NI$; n.m.r. in $CF_3\cdot CO_2H$, τ 6·67 (s, 3H), 6·70 (t, J = 6 c./sec., 2H), 5·12 (t, J = 6 c./sec., 2H), 1·50—2·30 (m, 9H). On the basis of these observations, the structure of this photoproduct was assigned to be 8-methylprotoberberinium iodide (II).‡

The reaction was extended to a tetramethoxy-derivative. 2-Acetyl-1-(3,4-dimethoxybenzylidene)-1,2,3,4-tetrahydro-6,7-dimethoxyisoquinoline (III), m.p. 192—193°, was synthesised and irradiated

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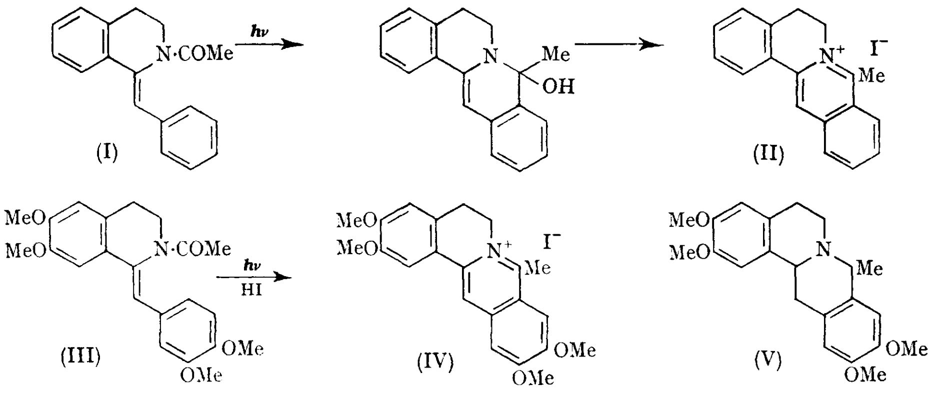
† Irradiations were carried out under nitrogen with a 550 watt Hanovia medium pressure mercury lamp enclosed in a Vycor well.

‡ Satisfactory elemental analyses and spectral properties in agreement with the assigned structures have been obtained for all new compounds.



in the presence of iodine and hydriodic acid. A yellow compound (IV) rapidly crystallized from the irradiation solution (methanol–tetrahydrofuran) in 75% yield. The structure of (IV) was established by its conversion to *β*-coralydine (V). Reduction of (IV) with sodium borohydride in ethanol afforded (V) in almost quantitative yield, m.p. 95—96° (lit.,[2] 95—96°), which exhibits an i.r. spectrum identical to that of the known compound.[2] Control experiments indicated that there was no reaction in the absence of light. The extension of this reaction to *N*-acyl derivatives of other benzylideneisoquinolines is being investigated.

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