A New Synthesis of a Crucial Intermediate for Ring B Bridged Diterpene Alkaloids

By Pak-tsun Ho, S. Oida, and K. Wiesner*

(Natural Products Research Center, University of New Brunswick, Fredericton, New Brunswick, Canada)

Summary An efficient high yield stereospecific synthesis of the key intermediate (6) is reported.

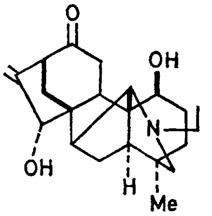
We have described recently a stereospecific and efficient conversion of compound (6) into the keto-lactam (2) and the verification of the structure of this intermediate by *X*-ray crystallography.[1]

Compound (3) (m.p. 264°)† has now been obtained in a similar fashion; it was subjected to a modified Wolff-Kishner reduction[2] and the product (4) (m.p. 233°) was isolated in 75% yield after crystallization. Treatment of this material with 48% hydrobromic acid in acetic acid gave the crystalline phenol (5) (m.p. 301°) in 80% yield. Since a model for a simple construction of the C/D ring system of songorine (1) had been available for some time,[3] there seemed to be no more obstacles to the total synthesis of this diterpene alkaloid.

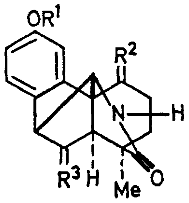
This, however, was not so. We have previously prepared our starting material (6) by a laborious and non-regiospecific method involving Diels–Alder addition of a cyclopentadienecarboxylate and a methoxy-*p*-quinone;[1] this soon became a bottleneck in the synthesis. We now report a novel synthesis of (6) by use of which several hundred grams of this material have been prepared in a few weeks.

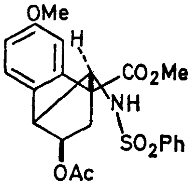
The readily available starting material (7)[4] was converted into (8) in 72% yield by reduction with sodium borohydride in methanol followed by boiling with methanolic 6% sulphuric acid. Heating compound (8) with maleic anhydride under nitrogen to 170° for 3 h gave the adduct (9) (m.p. 148°) in quantitative yield. The crude compound (9) was subjected to bisdecarboxylation[5] with dicarbonylbistriphenylphosphinenickel in anhydrous diglyme under nitrogen at reflux temperature for 6 h to give the olefin (10) (m.p. 64°) in 69% yield.

Compound (10) was treated with an excess of benzenesulphonyl azide in benzene at room temperature; the



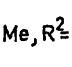
(1)

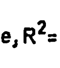




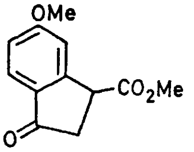
(6)

(2) R^1=Me, R^2=$<^{OH}_{H}$, R^3=$=$O

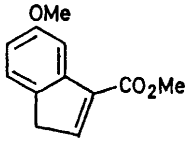
(3) R^1=Me, R^2=, R^3=$=$O

(4) R^1=Me, R^2=, R^3=H_2

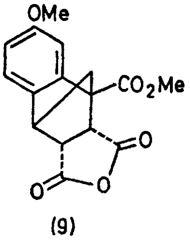
(5) R^1=H, R^2=$=$O, R^3=H_2



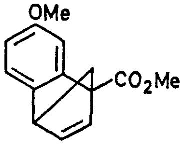
(7)



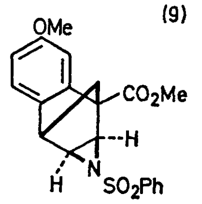
(8)



(9)



(10)



(11)

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† All compounds were characterized by n.m.r., i.r., and mass spectra. All crystalline compounds gave correct elemental analyses.

mixture was diluted with acetic acid and stored at room temperature for several days. The unstable aziridine (11) formed initially rearranged to compound (6) (m.p. 137°) in an overall yield of 75%.[6] The material was isolated simply by crystallization from benzene and was identical with an authentic sample.[1]

The overall yield of the conversion (7) → (6) was 38%.

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[2] W. Nagata and H. Itazaki, *Chem. and Ind.* 1964, 1194.
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[5] B. M. Trost and F. Chen, *Tetrahedron Letters*, 1971, 2603.
[6] For model system and mechanism see K. Wiesner and A. Philipp, *Tetrahedron Letters*, 1966, **14**, 1467.