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SYNTHESIS IN THE SERIES OF DITERPENE ALKALOIDS V.
AN APPROACH TO SONGORINE

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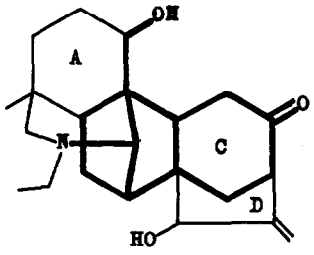
The alkaloid songorine (1) I in spite of its close relationship to veatchine (2) from which its skeleton differs only by one carbon-carbon bond, requires the development of new synthetic methods entirely unlike those used for the synthesis of the latter alkaloid (3). It was considered that the keto ester II would be an ideal starting material for songorine since it would allow a ready elaboration of ring A and the nitrogen ring after which the C-D ring system could be constructed from the substituted benzene ring by methods not unlike those used in the veatchine synthesis (3). We wish to describe now a four step stereospecific synthesis of II (R_1 = H, R_2 = $-SO_2-C_6H_5$). Cyclopentadiene carboxylic ester III (4) (ca. 18 g.) freshly prepared by distillation of the dimer was dissolved in dry tetrahydrofuran and a solution of the crystalline benzyne-precursor (5) IV (prepared from 26 g. of nitrobenzene sulfinic acid) in the same solvent

was added to it at -20°C. The mixture was then allowed to approach slowly room temperature and was allowed to stand for 15 hours. The oily ester V was isolated in a yield of 30% (based on the nitrobenzene sulfinic acid) by chromatography on silica gel. (Found: C, 78.17; H, 6.31; OCH_3, 15.13%; M.W. Mass spectrum: 200; I.R. ($CHCl_3$): 1735 cm^{-1}; N.M.R.: multiplet ($6H^1$) 2.7-3.2 τ, singlet ($4H^2$) 6.17 τ, almost unresolved doublet ($2H^3$) 7.47, 7.50 τ.) Alkaline saponification of V gave the corresponding acid (m.p. 126°C.; found: C, 77.27; H, 5.62%). The ester V (1 g.) was dissolved in 1.6 g. of benzene sulphonyl azide (6) and after 17 hours standing the mixture was chromatographed. The oily aziridine VI was obtained in a yield of 83%. (M.W. mass spectrum: 355; I.R. ($CHCl_3$): 1740 cm^{-1}; N.M.R.: multiplet (9 aromatic hydrogens) 2.1-2.85 τ, several peaks containing singlet for methoxyl ($6H^1$) 6.16-6.65 τ, quadruplet ($2H^2$) 7.61, 7.79, 8.18, 8.36 τ). The aziridine VI (338 mg.) was heated with 15 ml. of water for 24 hours. The hydroxy ester VII (m.p. 181°C.; found: C, 61.06; H, 5.12; N, 4.02%) was obtained in a yield of 97%. Oxidation of VII with the Jones reagent finally gave II (R_1 = H, R_2 = Ph-SO_2-) in a yield of 87%, (m.p. 140°C.; found: C, 61.42; H, 4.57; N, 3.81%; I.R. ($CHCl_3$): 1760, 1740 cm^{-1} broad; N.M.R. (after exchange with D_2O): multiplet (9 aromatic hydrogens) 2-2.76 τ; methoxyl (3H) 6.17 τ; ($2H^1$) 6.04 τ; ($2H^2$) quadruplet 6.9, 7.21, 7.68, 7.99 τ). The hydroxy ester VII may be also obtained almost quantitatively by acetolysis of VI followed



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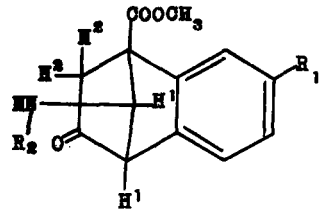

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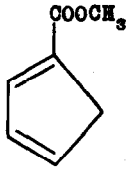

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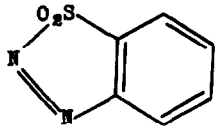

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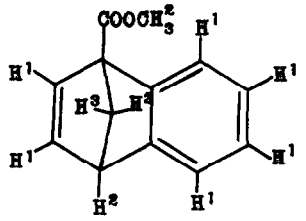

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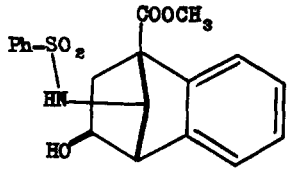

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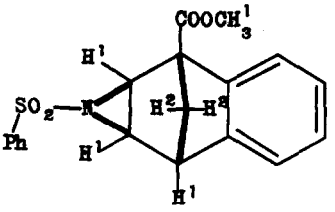

VI

by hydrolysis of the acetoxy group with methanolic hydrochloric acid. The sequence V → VI → VII is analogous to the formation and rearrangement of the benzene sulphonyl aziridine of norbornene (6). It is also analogous to the formation and rearrangement of benzonorbornene epoxide (7). The use of compound II and its analogues for the synthesis of songorine is under active investigation.

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