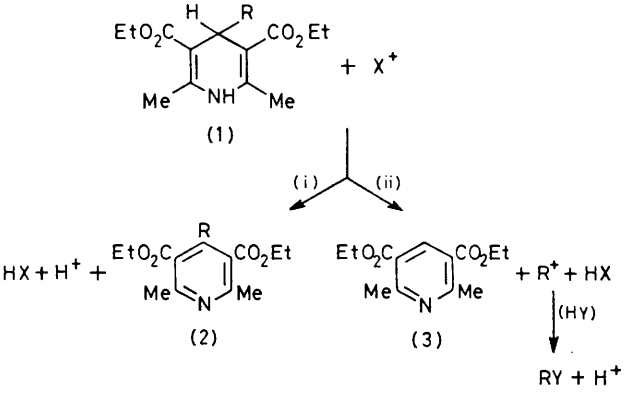
Dehydrogenation of Hantzsch Esters: Abnormal Course of Reaction of the 4-*p*-Dimethylaminophenyl Derivative

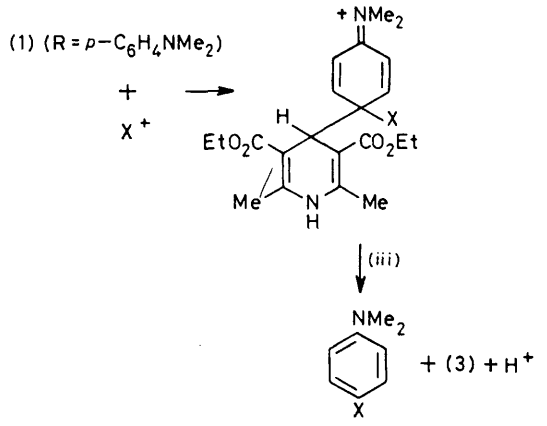
By REGINALD G. R. BACON*
(*Department of Chemistry, Queen's University of Belfast, Belfast* BT9 5AG)
and BOLANLE A. OSUNTOGUN
(*Department of Chemistry, University of Ife, Ile-Ife, Nigeria*)

Summary Reactions of diethyl 4-*p*-dimethylaminophenyl-2,6-dimethyl-1,4-dihydropyridine-3,5-dicarboxylate with various electrophiles, X^+, give diethyl 2,6-dimethylpyridine-3,5-dicarboxylate and compounds which include the *ipso* substitution products, *p*-$C_6H_4X{\cdot}NMe_2$.

STUDIES of hydrogen donation by 1,4-dihydropyridines[1] have frequently involved Hantzsch esters (**1**) as conveniently accessible representatives of the series. Variations in mechanism are apparent. Heterolytic routes, with an oxidant X^+, normally follow the course (i), giving the corresponding pyridine derivative (**2**). However, it has been shown[2] (with nitrous acid as oxidant; $X^+ = NO^+$) that if there is a 4-alkyl substituent (R), capable of carbonium-ion formation, dealkylation (ii) occurs, giving the pyridine derivative (**3**), unsubstituted at the 4-position.



We report a converse type of abnormal oxidation, observable with a 4-phenyl substituent carrying the strongly electron-donating *p*-dimethylamino group. Reactions were carried out with some oxidants which also function as reagents for electrophilic aromatic substitution. The mixtures of products were separated by chromatography on alumina. The dearylated pyridine derivative (**3**) was consistently obtained, and in favourable cases there was clear proof of attachment of the electrophile X^+ to the expelled aryl group. This process may be represented as an *ipso* substitution (iii) at the *para*-position of the aromatic nucleus.



Oxidation with sodium nitrite in acetic acid ($X^+ = NO^+$) occurred rapidly at ambient temperatures, giving the dearylated pyridine (**3**) (55—65%), *p*-nitrosodimethylaniline (yields of up to *ca.* 30%), and orange solids which are attributed to the known complexity of dimethylaniline nitrosation and to the possibility[3] of a secondary redox reaction between (**1**) and *p*-nitrosodimethylaniline. The failure of (**1**) (R = *p*-$C_6H_4NMe_2$) to undergo the expected reaction (i) with 'nitrous fumes' is known,[4] but has not hitherto been investigated. Significantly, oxidation (by nitric acid) of a corresponding quaternary salt (**1**) (R = *p*-$C_6H_4NMe_2Pr^+I^-$) was reported[5] to follow the normal course (i).

Analogous ready dearylation reactions occurred with halogens; *e.g.*, iodine chloride ($X^+ = I^+$) in acetic acid gave (**3**) (30%) and *p*-iododimethylaniline (44%). The pseudohalogen thiocyanogen[6] in dichloromethane also gave (**3**) (22%). With diazotised sulphanilic acid as oxidant ($X^+ = p$-$HSO_3C_6H_4N_2^+$), in aqueous acetone, (**3**) was obtained (34%), together with highly coloured products indicative of azo coupling. Reaction in acetic acid with mercury(II) acetate ($X^+ = HgOAc^+$) required several hours at reflux temperature and yielded (**3**) (64%), mercury, and an intractable purple product, presumably of the triphenylmethane series. This result is consistent with our observation that the expected mercurated derivative, *p*-$NMe_2C_6H_4HgOAc$, readily undergoes an intramolecular redox reaction in warm acetic acid, giving mercury(I) acetate, mercury, and similar purple solutions.

The observed fissions of the Hantzsch ester may be compared with those reported[7] for reactions of nitrous acid, bromine, or diazonium salts with *p*-dimethylaminophenylcarbinols.

(*Received*, 14*th September* 1979; *Com.* 983.)

[1] *E.g.*, R. E. Lyle, in 'Pyridine and its Derivatives,' Supplement, ed. R. A. Abramovitch, Wiley-Interscience, New York, 1974, part 1, pp. 137—182; E. M. Kosower, in 'Free Radicals in Biology,' ed. W. A. Pryor, Academic Press, London, 1976, vol. 2, pp. 1—53; A. D. B. Malcolm and J. R. Coggins in 'Enzyme Mechanisms,' *Ann. Reports* (*B*), 1974, **71**, 548—556.
[2] B. Loev and K. M. Snader, *J. Org. Chem.*, 1965, **30**, 1914.
[3] *Cf.* F. Kröhnke, K. Ellegast, and E. Bertram, *Annalen*, 1956, **600**, 176; H. Albrecht and F. Kröhnke, *ibid.*, 1967, **704**, 133; D. C. Dittmer and J. M. Kolyer, *J. Org. Chem.*, 1962, **27**, 56.
[4] L. E. Hinkel and H. W. Cremer, *J. Chem. Soc.*, 1920, **117**, 137.
[5] A. P. Phillips, *J. Amer. Chem. Soc.*, 1949, **71**, 4003.
[6] *Cf.* J. L. Wood, *Org. Reactions*, 1946, **3**, 240.
[7] M. Stiles and A. J. Sisti, *J. Org. Chem.*, 1960, **25**, 1691; A. Sisti, J. Burgmaster, and M. Fudin, *ibid.*, 1962, **27**, 279.