Extension of the Darzens Condensation to the Synthesis of Di- and Tri-substituted *N*-Phenyl-aziridines

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Summary The Darzens condensation has been extended to provide a synthesis of 1,3-diphenyl-aziridines bearing a nitrile or ester group in position 2; in some cases a cation effect on the stereochemical course of the reaction is observed.

Functionally substituted aziridines are interesting intermediates for cycloaddition reactions, but until now it has not been possible to synthesize by conventional procedures 1,3-diphenyl-aziridines (**1**) with X = CN or CO_2R and R^1 = H or Me,[1] although recently Pierre *et al.*[2] obtained in poor yield (**1**; R^1 = H, R^2 = Ph, X = CO_2Et) by reaction of diethyl diazoacetate with benzylidenaniline.

It is well known that the Darzens condensation is an excellent method for synthesis of epoxides but attempts to extend this reaction to the synthesis of diphenyl-aziridines by the action of stabilized α-halogeno-anions on imines are limited to the work of Deyrup[3] who isolated the ester (**1**; R^1 = H, R^2 = Ph, X = CO_2Et) in 30% yield, the *trans*-isomer predominating. The poor yields could be due to several factors, in particular the instability of the anionic reagents leading to by-products, or the low reactivity of imines compared to carbonyl compounds.

In the present investigation, t-butyl esters rather than ethyl derivatives (to reduce competition from Claisen condensation) and benzylidenaniline and the more reactive *m*-chlorobenzylidenaniline were used. The reactions have also been extended to the synthesis of nitrile derivatives using α-halogenonitriles at lower temperatures.

The reactions were carried out at low temperature with sublimed potassium t-butoxide or lithium bistrimethylsilylamide as the base in strictly anhydrous tetrahydrofuran under argon [reaction (1)].† We have thus obtained in good yields 2-esters and 2-carbonitriles not only of 1,3-

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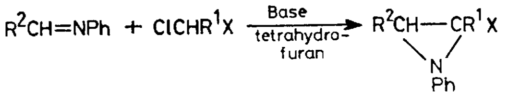
† With insufficiently purified base or solvent the yields drop dramatically.

TABLE. Reactions of the imines $R^2CH{=}NPh$ with the chloro-compounds $ClCHR^2X$ to give the aziridines (**1**).

					cis : *trans* ratio[b]	
R^1	R^2	X	T/°C	% Yield[a]	Bu^tOK	$(Me_3Si)_2NLi$
H	Ph	CO_2Bu^t	−50	85	30 : 70	>95 : 5
H	m-ClC_6H_4	,,	−50	90	35 : 65	>95 : 5
Me	Ph	,,	−15	60	30 : 70[c]	30 : 70
Me	m-ClC_6H_4	,,	−15	75	30 : 70[c]	30 : 70
H	Ph	CN	−80	50	*ca.* 100% *cis*	80 : 20
H	m-ClC_6H_4	,,	−80	70	*ca.* 100% *cis*	80 : 20
Me	Ph	,,	−80	75	15 : 85[c]	20 : 80
Me	m-ClC_6H_4	,,	−80	90	15 : 85[c]	15 : 85

[a] Yield of aziridine relative to starting imine. [b] *cis* and *trans* refer to the relative positions of the R^2 and X substituents. [c] A:B ratio, see ‡ footnote.



(1)

diphenyl-aziridine but also of 2-methyl-1,3-diphenyl-aziridine, which have not been prepared up to now (Table).

The aziridines were identified by n.m.r. spectroscopy‡ and purified by thick layer chromatography on neutral alumina or fractional crystallization. Yields were slightly greater for $R^2 = m$-ClC_6H_4 than for R^2 = Ph (Table).

An unexpected cation effect which depends on X and R^1 was also observed. For R^1 = H in the ester case only the *cis*-isomer is obtained with $(Me_3Si)_2NLi$,§ and the *trans*-isomer predominates with Bu^tOK; in the nitrile case only the *cis*-isomer is formed with K^+ and it remains predominant with $(Me_3Si)_2NLi$. When R^1 = Me the *trans*-isomer is always the major product for both esters and nitriles and the *cis* : *trans* ratio is independent of the cation K^+ or Li^+.

The aziridines do not isomerize under the reaction conditions and the mechanistic basis for this stereoselectivity, which is quite different from that obtained with carbonyl compounds,[4] is being investigated.

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‡ When R^1 = H, the *cis*- and *trans*-isomers are easily identified by n.m.r. spectroscopy [J_{HH} (*trans*) < J_{HH} (*cis*)]. However, when R^1 = Me, $\delta(H_A) > \delta(H_B)$ in CCl_4, but the identification of A and B isomers will be made by nuclear Overhauser effect measurements.

§ M. Vaultier (Université Rennes) has independently obtained the same result with Li^+ for (**1**; R^1 = H, R^2 = Ph, X = CO_2Et) personal communication.

[1] O. C. Dermer and G. E. Ham, 'Ethyleneimines and Other Aziridines,' Academic Press, New York, 1969; L. Wartski and C. Wakselman, *Bull. Soc. chim. France*, 1974, 1478; F. Texier and R. Carrie, *ibid.*, 1971, 4119; R. Huisgen, G. Szeimies, and L. Mobius, *Chem. Ber.*, 1966, **99**, 475.

[2] P. Baret, H. Buffet, and J. L. Pierre, *Bull. Soc. chim. France*, 1971, 2493.

[3] J. A. Deyrup, *J. Org. Chem.*, 1969, **34**, 2724.

[4] M. C. Roux-Schmitt, J. Seyden-Penne, and S. Wolfe, *Tetrahedron*, 1972, **28**, 4965; B. Deschamps and J. Seyden-Penne, *ibid.*, 1974, **27**, 3959.