Nuclear Magnetic Resonance Evidence for the Stereochemistry of the Indole Alkaloids Roxburghine B and E

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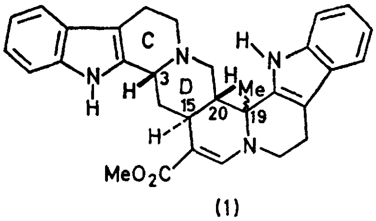
Summary Analysis of the n.m.r. spectrum of roxburghine E allows the relative configuration at centres 3, 15, and 20 to be deduced; the results are correlated with those for roxburghine B and D.



(1)

STRUCTURE (**1**) has been assigned[1] to roxburghine D, an indole alkaloid isolated, together with the four diastereoisomers, roxburghines A, B, C, and E, from a variety of *Uncaria* (Rubiaceae). The relative configuration shown in (**1**) was obtained by conformational analysis on the basis of

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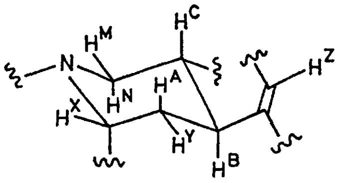
n.m.r. data. From biogenetical arguments[2] it is most likely that the configuration at centre 15 is α.

We report here an analysis of the n.m.r. spectrum of roxburghine E (**2**). The parameters in the Table (chemical shifts and coupling constants) were obtained by iterative analysis[3] of the seven-spin system corresponding to the protons ABCMNXY, and by decoupling experiments. If it is assumed, as usual, that ring D is more stable in the chair conformation, the coupling constants require that the C/D ring junction be *cis* and the D/E junction be *trans*. As a consequence, the orientation of the protons on rings D and E must be the same as in roxburghine D.



TABLE

Chemical shift (CDCl$_3$[a])		Coupling constants	
δ_{A}	1·612	J_{AB}	12·02 Hz
δ_{B}	2·001	J_{AY}	−13·68
δ_{C}	2·188	J_{AX}	4·60
δ_{M}	3·119	J_{BC}	11·35
δ_{N}	3·259	J_{BY}	3·40
δ_{X}	4·470	J_{CM}	3·21
δ_{Y}	3·350	J_{CN}	11·82
δ_{Z}	7·32	J_{XY}	2·50
δ_{Me-19}	1·63	J_{BZ}	0·9

[a] In acetone the signals do not undergo an appreciable solvent shift.

On the basis of the conformational arguments already used[1] for (**1**), it follows that both roxburghine D and E have the same relative configuration at centres 3, 15, and 20. Thus the two alkaloids must be epimers at C-19. The difference between the chemical shift for the C-19 methyl group, and that of the neighbouring protons H^B and H^C is consistent with this finding. It has already been established[1] that the configuration at C-19 in (**1**) is opposite to that in (**2**), *via* dehydrogenation to the enantiomeric dehydroroxburghines.

Since it has also been established[1] by equilibration that roxburghine B and E are epimers at C-3, the present results also give the relative configuration at centres 3, 15, and 20 of roxburghine B.

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[1] L. Merlini, R. Mondelli, G. Nasini, and M. Hesse, *Tetrahedron*, 1970, **26**, 2259.

[2] G. A. Morrison, *Fortschr. Chem. Org. Naturstoffe*, 1967, **25**, 269.

[3] A. A. Bothner-By and S. Castellano, 'Computer Programs for Chemistry,' ed. D. F. deTar, Benjamin, New York, 1968, p. 10.