

THE CRYSTAL AND MOLECULAR STRUCTURE OF THE METHIODIDE OF  
SWAZINE, AN ALKALOID FROM SENECIO SWAZIENSIS COMPTON.

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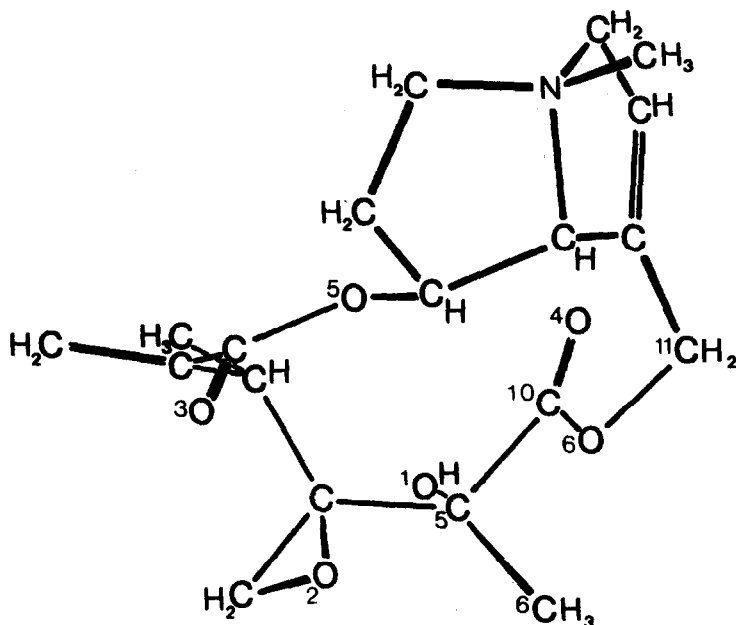
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The new alkaloid Swazine (I),  $C_{18}H_{23}NO_6$ , m.p.  $165^{\circ}$ ,  $(\alpha)_D^{20}$   $-103.5^{\circ}$  (EtOH),  $\lambda_{max}$  ( $H_2O$ ) 195nm ( $\epsilon$  11,000) was obtained from Senecio swaziensis Compton using the standard extraction procedure<sup>1</sup>. The nitrogenous base was readily shown to be retronecine<sup>2</sup>. Chemical and physical studies together with a crystal structure determination of a spiro-dilactone obtained by hydrolysis in 3N sulphuric acid, yielded the structure of the diacid moiety and hence an acceptable structure for the alkaloid itself<sup>3</sup>. Subsequent mass spectroscopic data<sup>4</sup> cast doubt on the proposed mode of attachment of the diacid chain to the retronecine nucleus; a complete structure determination was therefore undertaken.

Crystals of the methiodide  $C_{19}H_{26}NO_6I$  (supplied by Dr. C.G. Gordon-Gray) were monoclinic, space group  $P2_1$ ,  $a = 8.975$ ,  $b = 13.125$ ,  $c = 9.535$ , ( $\pm 0.005$ ) Å,  $\beta = 115.7^{\circ}$ ,  $Z = 2$ . Intensity data were measured on a diffractometer, using  $CuK_{\alpha}$  radiation. The structure was solved by the heavy atom method and has been refined isotropically by block diagonal least squares to  $R = 0.13$  for 1400 observed data. (All calculations were done with the local set of programs<sup>5</sup>; refinement is continuing).

The points of attachment between the diacid chain and the retronecine nucleus (Figure, a projection down a) are reversed relative to those previously suggested<sup>3</sup>. The presence of an epoxide group in the chain is confirmed, and its chemical inertness<sup>4</sup> is due to oxygen atom O(2) being shielded by the atoms O(6), O(3) and C(6); O(2)...O(6) 3.02, O(2)...O(3) 3.11, O(2)...C(6) 2.77 Å.



The bond lengths and angles are quite usual, and the values observed in the retronecine unit are very similar to those in jacobine<sup>6</sup>. The saturated 5-membered ring is exo buckled<sup>7</sup>. The configuration of the 12-atom diester ring is similar to that found in both jacobine and clivorine<sup>8</sup>. In each case the two ester C = O groups are close to co-linear, pointing in opposite

directions on either side of the mean plane of the 12-membered ring. This conformation is close to that previously predicted<sup>7</sup> for these diester rings, and is determined by the non-bonded contacts across the ring; C(11)...O(5) 3.55, C(10)...O(5) 3.65, O(6)...O(5) 3.19 Å. Atoms C(5), C(10), O(4), O(6) and C(11) are coplanar, with O(1) only 0.2 Å out of the plane, O(1)...O(4) = 2.69 Å, suggesting the presence of an intramolecular hydrogen bond<sup>7</sup>.

The groups C=CH<sub>2</sub> and C=O are approximately cis (rather than trans<sup>7</sup>) oriented with a dihedral angle of 54° between them. This implies that there is little or no conjugation between the groups and explains why the absorption in the U.V. region is at a wave length distinctly shorter than normally expected for the grouping CH<sub>2</sub>=C-C=O. (This unexpected anomaly led to confusion in the early stages of the chemical work<sup>4</sup>, when the interpretation of the NMR spectra<sup>7,9</sup> could not be reconciled with U.V. absorption spectrum).

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