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SWIETENOLIDE

J. D. Connolly, R. McCrindle, K. H. Overton and W. D. C. Warnock
Department of Chemistry, The University, Glasgow, W.2.

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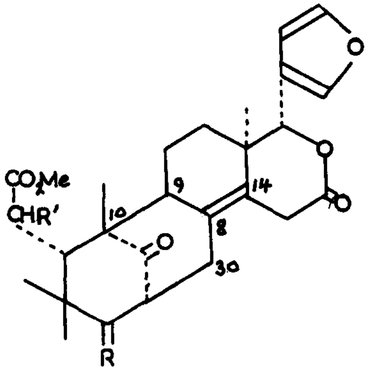
The seeds of <u>Swietenia macrophylla</u> contain two major tetranortriterpenoids, swietenine and swietenolide (1). Following our earlier report on the constitution of swietenine (2), we now summarise the salient evidence which leads to expression (I) for swietenolide.

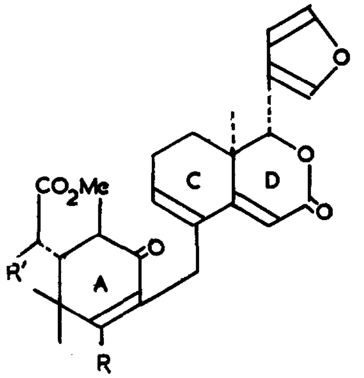


(I) R = βOH,H ; R' = OH
(II) $\Delta^{8(30)}$ - Isomer of I
(III) R = O ; R' = H.

In extending the preliminary work by Schwarz and Chakrabarrty (3) we have been led to the conclusion that swietenolide [we find m.p. 221-225°, $[\alpha]_D$ - 136° ($CHCl_3$)] is probably represented by a double bond isomer of destigloyl-swietenine (II). The underlying evidence will be detailed in our full publication. Two previously observed (3) reactions indicated a close structural similarity between swietenolide and mexicanolide (III). First, 3-dehydro-swietenolide had in neutral ethanol λ_{max} 210 mμ (ε 14,000), which changed on addition of alkali to λ_{max} 287 mμ (ε 34,200), to be replaced on acidification by λ_{max} 265 mμ (ε 14,700) (shoulder at 285 mμ). These changes reflect, as with mexicanolide (4), cleavage of the C-9, C-10 bond and formation of the diene-lactone (IV), $C_{27}H_{32}O_8$, $[\alpha]_D$+122°. Second, acetylation of swietenolide afforded, depending upon the conditions, either the 3,6-diacetate, $C_{31}H_{38}O_{10}$ m.p. 224-228°, $[\alpha]_D$-129°, or the monoacetate (V), $C_{29}H_{34}O_8$, m.p. 198-201°, $[\alpha]_D$+249°, whose ultra-violet absorption [λ_{max} 236 mμ (ε 11,600) and 278 mμ (ε 15,000)] and n.m.r. spectrum [vinyl protons at τ 3·87(C-3), 4·02 (C-9) and 4·30(C-15)] closely parallel those of the corresponding mexicanolide derivative (4).

On the evidence of these reactions, swietenolide is most simply formulated as (I), and this is well supported by comparing the n.m.r. spectra of 3-dehydro-swietenolide and mexicanolide (III). Attempts to relate swietenolide either to mexicanolide or swietenine directly have so far proved unsuccessful. However the constitutional problem of swietenolide has been solved in the following manner, at the same time providing additional support for the constitution of mexicanolide.

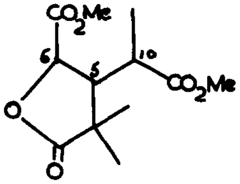
Oxidative cleavage by sodium periodate (5)*of the β-diketones, (IV) and (VI), derived respectively from swietenolide and mexicanolide, resulted in each case without loss of carbon, in the formation of two fragments, which were uniquely characterised by their analytical and spectroscopic properties.



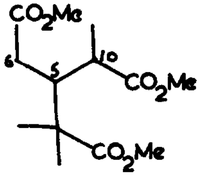
(IV) R = R' = OH

(V) R = H ; R' = OAc

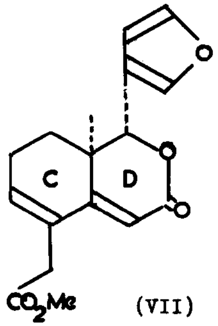
(VI) R = OH ; R' = H



(VIII)



(IX)



(VII)

Both diones afforded, after methylation of the oxidation products the same diene-lactone (VII), $C_{17}H_{18}O_5$, representing the common rings C and D, and having m.p. 147-149°, $[\alpha]_D$+387°, λ_{max}(EtOH) 272 mμ (ε 15,200) and 212 mμ (ε 9,000); n.m.r. signals in $CDCl_3$ at τ 2·5 and 3·5 (3H, α and β furan), 3·75 (C-9), 4·17 (C-15), 4·82 (C-17), 6·27 (3H, methyl ester), 6·70 (2H,C-30), 7·6 (2H,C-11), 8·5 (2H,C-12) and 8·92 (3H,C-18). The fragment representing ring A and its substituents differed in the two cases as anticipated. Thus the dione from swietenolide afforded the oily γ-lactone dimethyl ester (VIII), $C_{12}H_{18}O_6$, $[\alpha]_D$-8°, $\nu_{max}^{CCl_4}$ 1743 (methyl esters) and 1798 (γ-lactone)cm^{-1}, n.m.r. signals in benzene at τ 5·68 (doublet, J=8 c.p.s., C-6), 7·15 (quartet, J=8,9 c.p.s., C-5), 7·70 (multiplet, C-10), 6·70 (6H, methyl esters), 8·88, 9·08 (3H each, tertiary methyls), 9·07 (3H, doublet, J=6 c.p.s., secondary methyl); since only one lactone is formed, the structure of the less crowded isomer is preferred. Mexicanolide furnished the oily trimethyl ester (IX), $C_{13}H_{22}O_6$, $[\alpha]_D -26°$, $\nu_{max}^{CCl_4}$ 1738 cm^{-1}, n.m.r. signals in $CDCl_3$ at τ 6·30 (9H, methyl esters), 7·0–7·7 (4H, multiplet, C-5, C-6, and C-10), 8·8 (6H, two tertiary methyls) and 8·95 (3H, doublet, J=6 c.p.s., one secondary methyl).

REFERENCES

(1) S. S. Guha Sircar and T. Chakrabarrty, J. Indian Chem. Soc., 28, 207, (1951).

(2) J. D. Connolly, R. Henderson, R. McCrindle, K. H. Overton and N. S. Bhacca, Tetrahedron Letters, 37, 2593, (1964).

(3) T. Chakrabarrty, Ph.D. Thesis, Edinburgh, 1959.

(4) J. D. Connolly, R. McCrindle and K. H. Overton, Chemical Communications, 8, 162, (1965).

(5) M. L. Wolfrom and J. M. Bobbitt, J. Amer. Chem. Soc., 78, 2489, (1956).

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