Ring Expansions of Crombeone, a Natural 5-Hydroxypeltogynone

By E. V. BRANDT, D. FERREIRA, and D. G. ROUX*

(*Department of Chemistry, University of the Orange Free State, Bloemfontein, South Africa*)

Summary Crombeone, a natural 5-hydroxypeltogynone, undergoes addition reactions with diazomethane, resulting in expansion of the chromanone ring system.

HEARTWOOD extractives of *Acacia crombei* C. T. White contain considerable amounts of crombeone (I; R = H), a 5-hydroxydihydroflavonol analogue of the associated (+)-peltogynol (III). Crombeone is, however, isolated with difficulty, because of a number of factors including the occurrence of highly prominent side-reactions during the formation of certain of its derivatives.

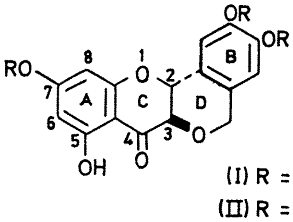
Reaction of diazomethane with enriched fractions of crombeone gives an unexpectedly large range of products, the majority of which were recognized as originating from single or repeated nucleophilic addition to the 4-carbonyl function. Crombeone trimethyl ether (II), an amorphous powder, m.p. 209° (decomp.), M^+ 358, $[\alpha]_D^{28}$ + 255° in pyridine, was obtained in low yield together with the predominant and crystalline Δ^6-oxepin-4-spiro-oxiran derivative (IV), m.p. 156°, M^+ 400, $[\alpha]_D^{28}$ −19·2°; an amorphous Δ^7-oxocin-4-one derivative (V), M^+ 400, $[\alpha]_D^{25}$ + 15·3°; and an amorphous 4-methoxymethylflavan-4-ol derivative (VI), M^+ 358, in which reaction with methanol in preference to formal ring expansion occurred after single addition.

These structures are consistent with n.m.r. and mass spectral interpretations. All compounds have in common an AB-quartet with *trans*-diaxial coupling due to heterocyclic protons [$J_{2,3}$ decreasing with increasing ring size: (II), 11·0; (IV), 9·5; (V), 9·5 Hz, and with (VI), 10·0 Hz as in peltogynol[1]], with the low-field doublet (2-H) in each instance broadened by benzylic coupling. Compound (IV) shows methylene signals at τ 5·50 (singlet, D-ring) 6·79 and 7·12 (AB quartet, C-ring, J_{AB} 15·0 Hz) and 6·69 and 7·51 (AB-quartet, oxiran ring, J_{AB} 6·5 Hz). In compound (V), methylene resonances occur as spin-coupled multiplets (τ 6·46—7·60), while acetylation of (VI) produces no significant shift in the methylene resonances. Compounds (II), (IV), and (V) produce a yellow colour with sulphuric acid, while (VI) forms a scarlet anthocyanidin.

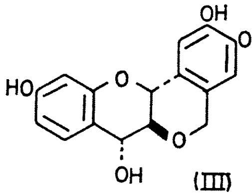
The absolute configuration (2*R* : 3*R*) of crombeone (I) was established by comparing the specific rotation of its trimethyl ether (II) with that of the corresponding (+)-peltogynone[1,2] (VII) {$[\alpha]_D^{28}$ + 255° and +189° resp., in pyridine}. The absolute configuration of (V) is accordingly known, while (IV) and (VI) have known absolute configurations at C-2 and C-3, but with the arrangements at C-4 still unknown.

Crombeone represents the first natural dihydroflavonol analogue of the mopanol–peltogynol group,[1] and also the first compound within this group possessing a phloroglucinol-derived A-ring. Crombeone is the only flavonoid compound known hitherto to undergo expansion of the heterocyclic ring on addition of diazomethane; a reaction not significantly afforded by either taxifolin (dihydroquercetin), maesopsin (2,4,4′,6-tetrahydroxy-2-benzylcoumaranone) or by peltogynone methyl ether (VII). In crombeone the facility of the reaction could result from the concurrence of a number of possible factors: (a) limited ring-strain in the C-ring through the presence of a second heterocyclic (D-ring) system; (b) the phloroglucinol A-ring acting as a stronger electron-releasing moiety than the resorcinol A-ring (as in peltogynone VII), thus promoting initial nucleophilic addition of diazomethane as well as subsequent migration of the aryl group; and (c) the strong hydrogen bond between the 5-OH and 4-C=O limits the rapid reaction of the 5-OH with diazomethane, in contrast to the strongly-dissociated 7-OH, thus preserving the desired nucleophilic character of the A-ring system for promoting addition and migration.

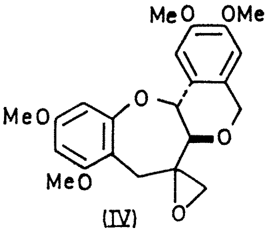
One of us (E. V. B). acknowledges the financial support provided by a Fellowship of the South African Industrial Cellulose Corporation. Thanks are due to Dr. Mary D. Tindale, Royal Botanic Gardens, Sydney, for collection and authentication of samples.



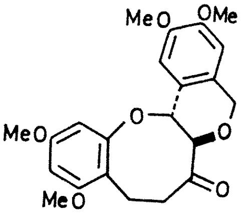
(I) R = H
(II) R = Me



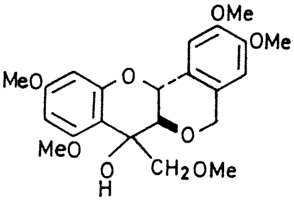
(III)



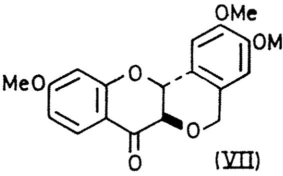
(IV)



(V)



(VI)



(VII)

(*Received, November* 19*th*, 1970; *Com.* 2006.)

---

[1] S. E. Drewes and D. G. Roux, *J. Chem. Soc.* (*C*), 1966, 1644.
[2] W. R. Chan, W. G. C. Forsyth, and C. H. Hassall, *J. Chem. Soc.*, 1958, 3174.