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REINVESTIGATION OF THE SUPPOSED ENEDIOL DIACETATE DERIVED FROM DIHYDROQUERCETIN 5,7,3',4'-TETRAMETHYL ETHER : NOVEL RING-FISSION OF DIHYDROQUERCETIN 5,7,3',4'-TETRAMETHYL ETHER TO α,2'-DIACETOXY-3,4,4',6'-TETRAMETHOXYCHALCONE.

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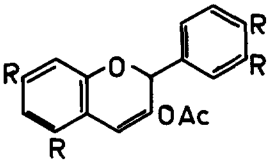
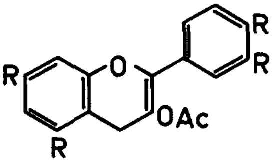
Reductive acetylation of quercetin has been shown to yield a mixture of 3,5,7,3',4'-penta-acetoxyflav-3- and -2-ene (Ia and IIa) (1,2,3) in the proportion 4:1(3), and quercetin 5,7,3',4'-tetramethyl ether is considered (4) to give the analogous 3-acetoxy-5,7,3',4'-tetramethoxyflav-3-ene (Ib), probably mixed with the flav-2-ene (IIb). The claim that reductive acetylation of dihydroquercetin (1) also gives the flav-3-ene acetate (Ia) has been withdrawn (4), and acetylation catalysed by sodium acetate or pyridine is said to give the cyanidin pseudo-base acetate (IIIa) (4) probably accompanied by the isomeric pseudo-base acetate (IVa) (2). Dihydroquercetin 5,7,3',4'-tetramethyl ether was said to give a similar mixture of pseudo-base acetates (IIIb and IVb) (4).

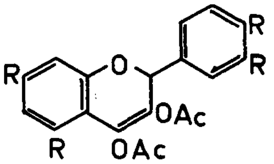
Our reinvestigation of the base-catalysed acetylation of dihydroquercetin tetramethyl ether does not support the proposed (4) structures (IIIb and IVb). Acetylation as specified (4) with acetic anhydride and sodium acetate for 1 hr. gave dihydroquercetin tetramethyl ether 3-acetate (over 85%), and when boiled with hydrochloric



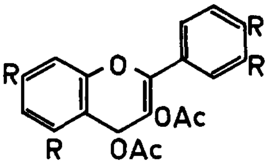
Ia, R = OAc; Ib, R = OMe



IIa, R = OAc; IIb, R = OMe

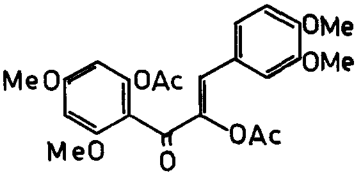


IIIa, R = OAc; IIIb, R = OMe

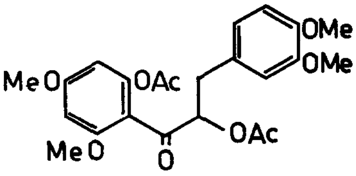


IVa, R = OAc; IVb, R = OMe

acid neither the crude reaction mixture nor the various fractions gave a colouration indicative of anthocyanidin formation. By thin-layer chromatography the reaction mixture was shown to contain three components : the normal acetate (R_F 0.2), an unidentified component (R_F 0.3), and a third compound (R_F 0.4) later identified as α,2'-diacetoxy-3,4,4',6'-tetramethoxychalcone (V).



V



VI

When acetylation was continued for progressively longer times thin-layer chromatography showed that the chalcone (V) increased, dihydroquercetin tetramethyl ether 3-acetate disappeared, and the spot due to the unidentified component (R_F 0.3) became very faint. Reaction proceeded faster with potassium acetate although the reaction mixture contained the same components. The chalcone (V) was formed in 73% yield after acetylation for 10 hr. with sodium acetate and in 51% yield after 1½ hr. with potassium acetate as catalyst, and it crystallised in yellow prisms, m.p. 139.5°, light absorption in ethanol: λ_{max} 252 (log ε 4.06) and 344 mμ (log ε 4.27).

The structure of the chalcone (V) was inferred from n.m.r. and infrared spectra (acetate carbonyl 1768 cm^{-1}, chalcone carbonyl 1668 cm^{-1}, C=C 1632 cm^{-1}, close to values obtained with model compounds). The structure was unambiguously established by catalytic hydrogenation to the dihydrochalcone (VI), which revealed the $-CH_2-CH\langle$ grouping as a typical ABX multiplet (H_A σ 3.14, H_B σ 2.91, H_X σ 5.97 p.p.m., J_{AB} 14.3, J_{AX} 9.7, J_{BX} 3.2 c/s), and was finally proved by unambiguous synthesis of the dihydrochalcone (VI) from 2,4-dimethoxy-6-hydroxy-acetophenone in seven stages (39% over-all yield).

The properties of the chalcone (V) agree closely with those recorded (4) for the endiol diacetate (IIIb) and leave little doubt of their identity. The chalcone was converted into the 2-hydroxy-2-benzylcoumaranone (98%), m.p. 179.5-180.5°, as expected by aqueous potassium hydroxide in tetrahydrofuran at room temperature, and in lower yield (49%) and m.p. 176.5-177°, by boiling hydrochloric acid-ethanol (2 hr.). The 2-hydroxy-2-benzylcoumaranone was identical with a synthetic sample, gave the expected aurone colour reaction with sulphuric acid, and depressed the m.p. of dihydroquercetin tetramethyl ether.

3-Hydroxy-7,3',4'-trimethoxyflavanone, prepared by standard methods, gave the 3-acetate with acetic anhydride and pyridine or sodium acetate. It failed to yield a chalcone analogous to (V), so that ring fission appears to be a characteristic of dihydroflavonol methyl ethers derived from phloroglucinol. The Pachéco test for phenolic dihydroflavonols (5) apparently leads to anthocyanidins and we conclude that the methyl ethers of dihydroflavonols behave differently from the phenols in base-catalysed acetylation.

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