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A STRUCTURAL ISOMER OF PELTOGYNOL TRIMETHYL ETHER; 3-HYDROXYCOUMARAN-2-SPIRO-3'-ISOCHROMANS, A NEW CLASS OF SYNTHETIC LEUCOANTHOCYANIDINS.

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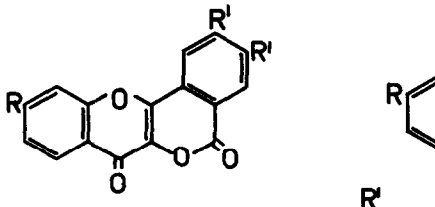
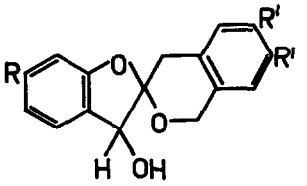
Reduction of the flavone (Ia), m.p. 287°, with lithium aluminium hydride in ether has been found to yield 3-hydroxycoumaran-2-spiro-3'-isochroman (3-hydroxy-4,5,5',6'-tetrahydro-2,3-benzofuran-5-spiro-6'-3',4'-benzo-2'H-pyran)(IIa), m.p. 171-172°, and the 7-methoxyflavone (Ib), m.p. 291-292°, and trimethoxy analogue (Ic), m.p. 322°, were similarly converted into the spirans (IIb and IIc), m.ps. 169-170° and 201.5-202°. These spirans easily undergo cleavage with acid to the isochromens, as expected from their ketal structures (II), and subsequent ring closure and oxidation occurs readily to yield the flavylium salts (III). The trimethoxyspiran (IIc) has already been described (1) as a stereoisomer of peltogynol trimethyl ether, and was converted (1) into peltogynidin trimethyl ether (IIIc).

The structure of the flavone (Ia), obtained by standard methods, was confirmed by infrared spectroscopy and mass spectrometry (parent ion 264); the reduction product (IIa) gave the parent ion at 254 mass units. The spiran structures of the reduction products (II) were inferred

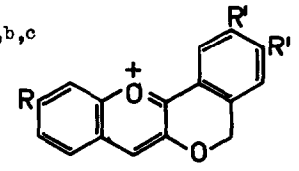
initially from examination of the n.m.r. spectrum of the spiran (IIa), which appeared chromatographically homogeneous (t.l.c.) but in solution in deuterochloroform occurred as a mixture of the cis-isomer (83%) and



I; a,b,c



II; a,b,c



III; a,b,c

a; R = R' = H
b; R = OMe, R' = H
c; R = R' = OMe

the trans-isomer (17%)(cis and trans refer to the configuration of the 3-hydroxyl relative to the isochroman-O). The two methylene groups absorbed as AB quartets, and double irradiation showed that the 3-proton and the low- and high-field methylene groups were not coupled, thus establishing the spiran structure (IIa). The low-field quartet (J_{AB} 15.4 c/s, σ_A 5.08, σ_B 4.80 p.p.m. in both isomers) was superimposed on the signal of the 3-proton (83%) of the cis-isomer at σ 4.91 and the 3-proton (17%) of the trans-isomer at σ 4.74 p.p.m. The high-field quartet appeared unsymmetrical due to superposition of the quartet due to the cis-isomer (J_{AB} 17.6 c/s, σ_A 3.18, σ_B 3.10 p.p.m.) on that due to the trans-isomer (J_{AB} 17.6 c/s, σ_{AB} 3.11, $\Delta\sigma_{AB}$ less than 1.0 c/s) and integration of this region confirmed the ratio of isomers (83:17). The hydroxyl proton also absorbed in this region (σ 2.77 p.p.m.). Examination of models shows that the 3-hydroxyl group in the cis-isomer is symmetrically placed with respect to the C-CH_2-Ar group responsible

for the high-field quartet ($\Delta\sigma_{AB}$ 10.7 c/s), but unsymmetrically placed in the trans-isomer ($\Delta\sigma_{AB}$ less than 1.0 c/s), and this evidently accounts for the difference in $\Delta\sigma_{AB}$ in the two isomers. The cis-methoxyspiran (IIb) similarly showed high- and low-field quartets in its n.m.r. spectrum but equilibration to the trans-isomer (17%) occurred only during deuterium exchange. The spectrum of the cis-trimethoxyspiran (IIc) was simpler because the two methylene absorptions occurred as singlets (σ 3.12 and 4.92 p.p.m.), with small shoulders on the high-field sides attributed to a very small proportion of the trans-isomer; the proportion of trans-isomer increased slightly during deuterium exchange.

The flavylium salts derived from the spirans (IIa,b, and c) were yellow, orange, and carmine red respectively, and the flavylium salt from the spiran (IIc) was indistinguishable from peltogynidin trimethyl ether in colour and R_F on paper chromatograms. Peltogynol trimethyl ether was prepared by methylation of peltogynol extracted from Peltogyne porphyrocardia, and its n.m.r. spectrum ($J_{2,3}$ 10.1 c/s, $J_{3,4}$ 8.5 c/s) unequivocally confirmed the 2,3-trans-3,4-trans-configuration (2).

3-Hydroxy-2-benzyloxy-2-benzylcoumarans, analogous to the spirans (II) but lacking the ether bridge to the 2-aryl ring, may be expected to yield normal flavylium salts on treatment with acid in the presence of oxygen, and thus represent a new general class of leucoanthocyanidin.

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