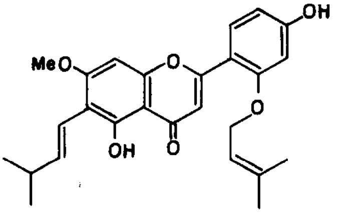
Tetrahedron Letters No.2, pp. 125-128, 1964. Pergamon Press Ltd.
Printed in Great Britain.

CYCLOARTOCARPIN

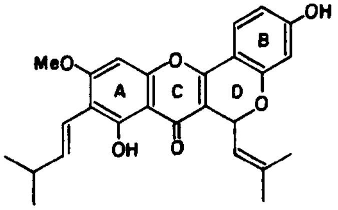
P. M. Nair, A. V. Rama Rao and K. Venkataraman
National Chemical Laboratory, Poona, India

(Received 18 November 1963)

The structure I assigned to isoartocarpin, a flavonoid pigment isolated from the heartwood of *Artocarpus integrifolia*,[1] has to be modified to II in the light of NMR and mass spectral data which have now become available. The NMR spectra were taken on an A-60 spectrometer, and the chemical shifts are cited on the τ scale. Isoartocarpin, dihydroisoartocarpin and tetrahydroisoartocarpin were dissolved in pyridine or dimethyl sulphoxide, and the ethers in carbon tetrachloride.



I



II

The NMR spectrum of isoartocarpin dimethyl ether shows that it does not have a γγ-dimethylallyl ether group as in structure I. The region 5.0-6.0 is transparent, indicating

---

[1] K. G. Dave, S. A. Telang and K. Venkataraman, *Tetrahedron Letters* No.1, 9 (1962).

the absence of an allylic OCH_2-. The vinyl proton of the prenyl group of structure I is expected to give a triplet in the region 4.5-5.0, and the spectrum of the tetrahydro derivative should be blank in the region 4-5. However the single proton signal observed at 4.67 is a broad doublet (J=9.5 cps), and it is replaced by a quartet at 4.42 in the spectrum of the tetrahydro derivative. In tetrahydroisoartocarpin dimethyl ether the number of protons absorbing in the range 2.0-4.0 is only four, while the number expected from structure I is five, including the 3-proton of ring C. The spectrum of isoartocarpin dimethyl ether gives a total proton count of 30 and not 32, indicating the presence of an additional ring in the molecule. This is confirmed by the mass spectrometric determination of the molecular weights of isoartocarpin and its dimethyl ether, which are 434 and 462 respectively (and not 436 and 464).

The NMR data support the substitution of ring A as in structure I. The presence of an isopropyl group on a double bond is indicated by the single proton multiplet around 7.6 and the 6-proton doublet (J=7 cps) centered at 8.90 in the spectrum of the dimethyl ether. When isoartocarpin is reduced to its dihydro derivative, two vinyl protons disappear and two methylene groups appear, one of them being benzylic. The chelated hydroxyl group shows up at -4.08 and the methoxyl at 6.10 in the spectrum of isoartocarpin in pyridine.

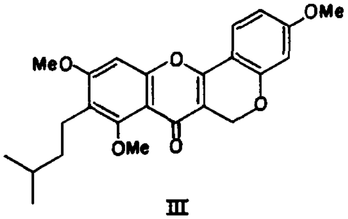
The reported formation[1] of 2-hydroxy-4-methoxybenzoic acid by the alkaline hydrolysis of isoartocarpin dimethyl ether has been verified; a readily hydrolysable ether group is therefore present in the 2'-position of the B-ring, and the structural feature requiring revision is the C_5H_9 fragment of I. Since dihydroisoartocarpin gives acetone and a non-volatile aldehyde on ozonolysis, and NMR data show that in the reduction of dihydroisoartocarpin to tetrahydroisoartocarpin a trisubstituted double bond is hydrogenated, the only alternative to structure I is II, which is in good agreement with all the available evidence, except the dealkylation reaction discussed below. The broad doublet at 4.67 in the spectrum of isoartocarpin dimethyl ether may be assigned to the vinyl proton of the side chain attached to ring D, the 9.5 cps coupling being to the adjacent proton on the ring. There is a doublet centered at 3.84 with the same coupling (9.5 cps), and it may be assigned to the ring D proton. In the spectrum of tetrahydroisoartocarpin dimethyl ether this signal is shifted upfield to 4.42 and appears as a quartet, because the proton is on an asymmetric carbon atom and the methylene group of the side chain forms an AB system.[2] In conformity with structure II isoartocarpin is

---

[2] (a) P. M. Nair and J. D. Roberts, *J. Amer. chem. Soc.* *79*, 4565 (1957); (b) J. N. Shoolery and B. Crawford, *J. Mol. Spectroscopy* *1*, 270 (1957); (c) J. A. Pople, W. G. Schneider and H. Bernstein, *High Resolution Nuclear Magnetic Resonance* pp. 88, 119-123. McGraw-Hill Book Co., New York (1959); (d) G. M. Whitesides, F. Kaplan, K. Nagarajan and J. D. Roberts, *Proc. nat. Acad. Sci., USA* *48*, 1112 (1962).

optically active; the dimethyl ether has $[\alpha]_D^{25}$: + 1.19° ($\underline{c}$ = 2.25 g/100 ml, chloroform).

By the action of halogen acids on dihydroisoartocarpin and tetrahydroisoartocarpin, followed by methylation, Telang[3] obtained a compound, m.p. 191°, which he considered to be 6-isoamyl-5,7,2',4'-tetramethoxyflavone, although he recorded the fact that the Zeisel methoxyl value corresponded to 3 and not 4 methoxyl groups. We have repeated the two reactions on tetrahydroisoartocarpin and found that the product is a mixture containing the compound, m.p. 191°, as shown by thin layer chromatography and NMR spectrum. This compound shows three methoxyl groups (6.13, 6.18 and 6.24) and an allylic OCH_2 at 4.83 (singlet) in the NMR spectrum, and the mass spectral molecular weight is 410. These facts are in agreement with structure III, but we are at present unable to explain the fission of the C-C bond involved in the conversion of II to III.



III

Cycloartocarpin is suggested as a more appropriate name for isoartocarpin.

We are grateful to Dr. J. S. Shannon and Dr. S. Sternhell of the Division of Coal Research, CSIRO, Australia, for the mass spectra and for valuable comments on the NMR assignments.

---

[3] S. A. Telang, Ph.D. Thesis, University of Bombay (1961).