

**Synthesis of 5,7,3'-Trihydroxy-6,4'-dimethoxy-
isoflavone isolated from *Iris germanica*
Rhizomes by Wessely-Moser Rearrangement**

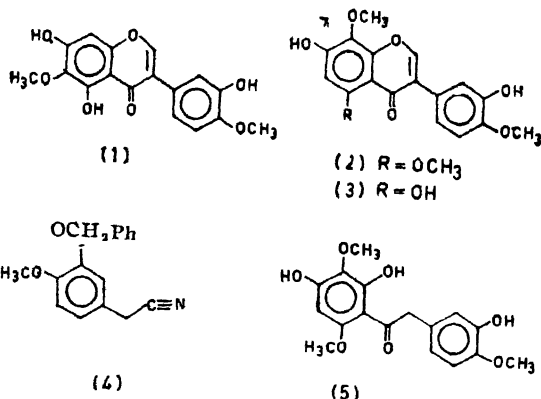
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PAILER and Franke reported the isolation of some isoflavones from *Iris germanica* rhizomes. One of these was assigned the constitution, 5,7,3'-trihydroxy-6,4'-dimethoxyisoflavone (**1**) merely based on degradation and spectral studies. No synthetic evidence has yet been put forward. In the present paper the synthesis of this natural product has successfully been accomplished by way of Wessely-Moser rearrangement, thereby confirming the proposed structure. In the synthesis, 3-benzyloxy-4-methoxyphenylacetonitrile (**4**) and 1,3-dibenzyloxy-2,5-dimethoxybenzene were employed as the key materials. For the synthesis of **4**, 3-benzyloxy-4-methoxyphenylpyruvic acid was secured from isovanillin in three steps, viz. *o*-benzylation followed by the synthesis of the related azlactone and subsequent conversion to pyruvic acid. This was then converted to the oxime and

then to the corresponding nitrile (4, $\nu_{\max}$ 2 200 cm^{-1})^{2,3}.

Hoesch condensation of 1,3-dibenzyloxy-2,5-dimethoxybenzene with compound 4 in dry ether containing fused zinc chloride yielded 2,4-dihydroxy-3,6-dimethoxyphenyl-3-hydroxy-4-methoxybenzyl ketone (5, $\nu_{\max}$ 1 620 cm^{-1}).



Compound 5 on ring closure in the presence of ethyl formate-sodium metal gave 7,3'-dihydroxy-5,8,4'-trimethoxyisoflavone (2). Partial demethylation of 2 with aluminium chloride in presence of acetonitrile afforded 5,7,3'-trihydroxy-8,4'-dimethoxyisoflavone (3) in good yield. This when refluxed with methanolic potash, followed by acidification, underwent Wessely-Moser rearrangement to give the target compound (1).

Experimental

All m.ps. and b.ps. are uncorrected. Infrared spectra (KBr) were recorded on a Perkin-Elmer 237 spectrophotometer.

3-Benzyloxy-4-methoxyphenylacetonitrile (4): The oxime of 3-benzyloxy-4-methoxyphenylpyruvic acid (8.0 g) was heated on a water-bath with acetic anhydride (10 ml) for 5 min, then poured into ice-water and extracted with ether. The ethereal layer was washed with cold aqueous NaOH (3%), then with water and dried (MgSO₄). On evaporation it gave a viscous liquid which was distilled at 100°/2 mm to yield again a viscous liquid which solidified immediately on cooling. It was crystallised from chloroform-petroleum ether as yellow needles, m.p. 78–79° (lit.² 77–79°; lit.³ 80°), $\nu_{\max}$ 2 240 cm^{-1} (C≡N).

2,4-Dihydroxy-3,6-dimethoxyphenyl-3-hydroxy-4-methoxybenzyl ketone (5): A solution of 4 (1.0 g) and 1,3-dibenzyloxy-2,5-dimethoxybenzene (7.0 g) in dry ether (100 ml) containing fused zinc chloride (2.0 g) was saturated with dry hydrogen chloride gas at 0° for 4 h. After keeping the mixture overnight in a refrigerator, ether was decanted off and the organozinc complex was worked up in the usual manner. The required deoxybenzoin was

eluted from the column of silica gel with 2% ethyl acetate-benzene mixture. The crude compound was crystallised from ethyl acetate-petroleum ether as light yellow rods, m.p. 277–79° (Found: C, 60.86; H, 5.64. C₁₇H₁₈O₇ requires: C, 61.07; H, 5.43%); $\nu_{\max}$ 1 620 cm^{-1} ; it gave greenish brown colour with alcoholic ferric chloride.

7,3'-Dihydroxy-5,8,4'-trimethoxyisoflavone (2): The above deoxybenzoin (1.5 g) was dissolved in dry and freshly distilled ethyl formate (15 ml) and powdered sodium (2.0 g) was then added portion-wise. The reaction mixture was left overnight at room temperature. The excess of sodium was decomposed by adding ethanol. Concentrated HCl acid was then added and the mixture was warmed on a water-bath for 15–20 min. It was diluted with water and worked up in the usual manner. The resulting solid was crystallised from chloroform-petroleum ether as deep yellow crystals, m.p. 275–76° (Found: C, 62.79; H, 5.01. C₁₈H₁₆O₇ requires: C, 62.79; H, 4.68%).

5,7,3'-Trihydroxy-8,4'-dimethoxyisoflavone (3): A solution of 2 (1.5 g) in dry acetonitrile (50 ml) was refluxed with anhydrous aluminium chloride (2.0 g) on a water-bath for 3 h. The solvent was then removed and the complex was decomposed by heating with cold dilute HCl (1:1; 30 ml) for 20 min. The resulting solid was crystallised from chloroform-ethanol as yellow needles, m.p. 200–01° (Found: C, 61.59; H, 4.46. C₁₇H₁₆O₇ requires: C, 61.82; H, 4.27%).

5,7,3'-Trihydroxy-6,4'-dimethoxyisoflavone (1): A mixture of the above isoflavone (0.5 g) and methanolic KOH (2%; 50 ml) was refluxed for 15 min, then cooled, acidified, diluted. The resulting solid was crystallised from ethanol as white needles, m.p. 165–66° (lit.¹ 163–66°) (Found: C, 61.60; H, 4.52. C₁₇H₁₄O₇ requires: C, 61.82; H, 4.27%); $\nu_{\max}$ 3 470, 1 650, 1 620, 825, 810 and 730 cm^{-1} . The compound was identified by comparison with an authentic sample (co-tlc, m.m.p., superimposable ir spectra).

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