The Isolation and Structures of the Fungal Metabolites Lapidosin and Diversonol

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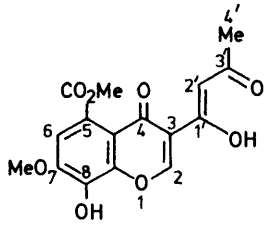
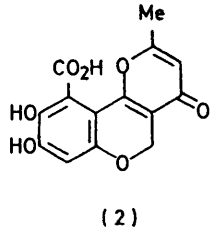
The isolation of lapidosin (1) from *Penicillium lapidosum* and of diversonol (4) from *P. diversum* is described and possible biosynthetic origins are suggested.

THE genus *Penicillium* is a rich source of polyketide metabolites [1a] and I report here the isolation and structures of two further examples, each of which has a feature of biosynthetic interest. The structures of the compounds were determined by *X*-ray analysis, to be reported elsewhere, by Dr. J. Clardy.

Lapidosin (1) is a metabolite of *Penicillium lapidosum* and has the carbon skeleton of citromycetin (2) and fulvic acid (3). Fulvic acid has been shown [2] to be derived



(1)



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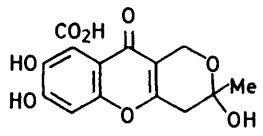

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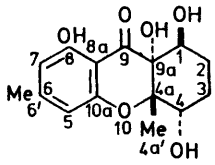

(4)

from two polyketide chains, and lapidosin probably becomes the third member of this rather unusual group of fungal metabolites. The spectroscopic properties of lapidosin (see Experimental section) are unexceptional, but care should be taken to avoid heating solutions in dimethyl sulphoxide for n.m.r. determination because rapid decomposition of lapidosin takes place; solutions in chloroform are stable to heat.

Diversonol (4) a metabolite of *P. diversum*, appears to be related biosynthetically to the sulochrin group of fungal metabolites [1b] which are derived by cleavage of an anthraquinone intermediate.[3] If this view of its biosynthesis is correct, the 4a'-methyl group of diversonol results from complete reduction of a carbonyl intermediate, an unusual process in polyketide biosynthesis. As expected the u.v. spectrum of diversonol is similar to that of 2'-hydroxy-6'-methoxy-4'-methylacetophenone.[4]

EXPERIMENTAL

Isolation of Lapidosin.—Penicillium lapidosum (CBS 343.48, number 950 in our collection) was grown under stirred aerated conditions on Raulin–Thom medium with 5% Dextrolact. After 114 h the culture filtrate was adjusted to pH 2 and extracted with chloroform to give a glass which was chromatographed on silica gel. Elution with chloroform gave a fraction which was crystallized from acetone to give *lapidosin* (1) (*ca.* 100 mg l^{-1}) as cream needles, m.p. 212—220 °C (decomp.), $\nu_{max.}$(Nujol) 3 210, 2 700, 1 719, 1 662, 1 625, and 1 570 cm^{-1}; δ_H ([$^2H_6$]DMSO) 9.20 (H-2), 7.50 (H-6 or H-2'), 7.12 (H-6 or H-2'), 4.06 (OCH_3), 3.95 (OCH_3), and 2.22 (H-4'); δ_H ($CDCl_3$) (FT) 8.76 (H-2), 7.03 (H-6 or H-2'), 7.02 (H-6 or H-2'), 4.03 (OCH_3), 4.00 (OCH_3) and 2.58 (H-4') (Found: C, 57.5; H, 4.2%; *m/e* 334. $C_{16}H_{14}O_8$ requires C, 57.5; H, 4.2%; *M*, 334).

Isolation of Diversonol.—Penicillium diversum (ATCC 10437, number 946 in our collection) was grown in surface culture on Raulin–Thom medium with Dextrosol (5%), yeast extract (0.01%), and minor element concentrate (0.1%). After 29 days the culture filtrate was adjusted to pH 6.2 and extracted with chloroform. The extract was divided into neutral, acidic, and phenolic fractions, and the phenolic fraction was chromatographed on silica gel. Elution with benzene–chloroform (9 : 1) gave *diversonol* (4), m.p. 236—238 °C (from acetone–benzene); $\nu_{max.}$(Nujol) 3 555, 3 410sh, 3 355, 3 245, 1 659, 1 633, and 1 572 cm^{-1}; $\lambda_{max.}$(MeOH) 273 (ε 12 400) and 350 nm (3 130); δ_H ([$^2H_6$]DMSO) −1.30 (8-OH), 6.31 (H-5 and H-7), 6.73 (1-OH or 4-OH), 4.99 (*J* = 4 Hz, 1-OH or 4-OH) 4.32 (H-1 or H-4), 4.05 (H-1 or H-4), 2.24 (H-6'), and 1.40 (H-4a'); δ_H ([$^2H_6$]DMSO) 194.4 (C-9), 161.7 (C-10a), 158.6 (C-8), 149.5 (C-6), 109.0 (C-5 or C-7), 108.8 (C-5 or C-7), 104.6 (C-8a), 81.2 (C-9a), 75.6 (C-4a), 73 .5(C-1), 66.3 (C-4), 24.9 (C-2 or C-3), 22.7 (C-2 or C-3), 21.9 (C-6'), and 19.5 (C-4a) (Found: C, 61.2; H, 6.2%; *m/e*, 294. $C_{15}H_{18}O_6$ requires C, 61.2; H, 6.2%; *M*, 294). Diversonol gives a green colour with ferric chloride.

I am indebted to Mr. G. L. F. Norris for the fermentations and Mr. D. Greatbanks for the n.m.r. spectra.

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