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THE STRUCTURE AND SYNTHESIS OF DESMETHYLHERQUEICHRYSIN

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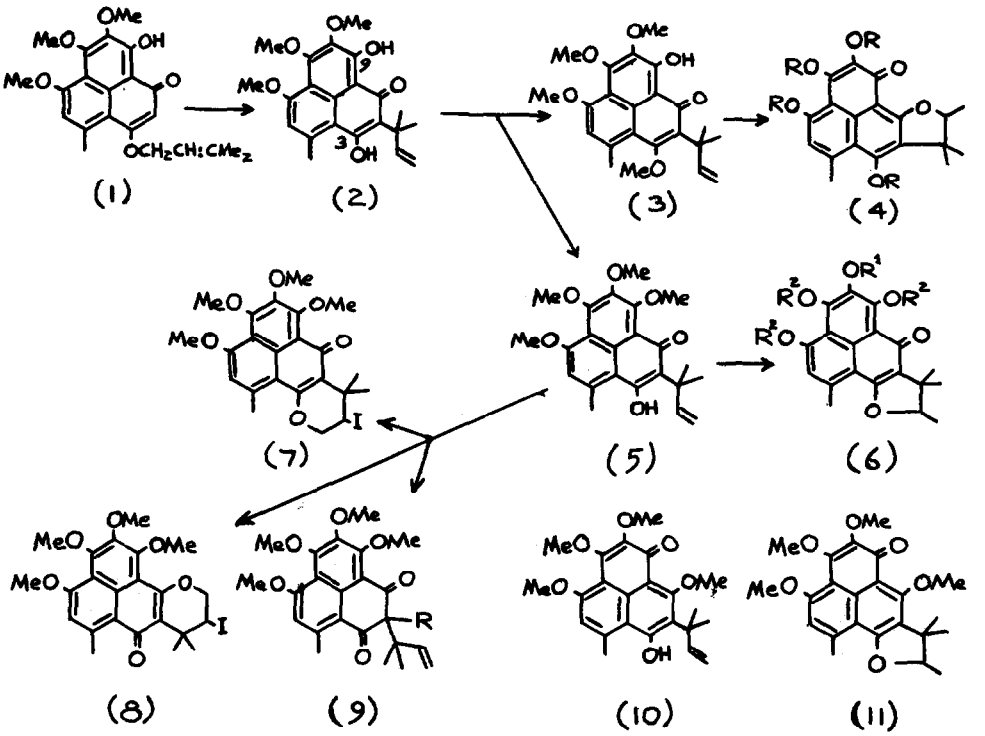
Herqueichrysin, a metabolite of P. herquei, is isomeric with deoxyherqueinone (6; R' = Me, R^2 = H), and its spectra indicate that, like that compound, it contains a methoxy group and a phenalenone nucleus fused to a 1,2,2-trimethyldihydrofuran ring. Since desmethylherqueichrysin, obtained by demethylation of herqueichrysin with pyridine hydrochloride[1] or hydriodic acid,[2] is not identical with atrovenetin (6; R' = R^2 = H)[3] it is clear that the orientation of the ether ring must differ from that found in the other phenalenone-based pigments of P. herquei.

On biogenetic grounds structure (4; R = H) would appear to be the most probable structure for desmethylherqueichrysin.[1,2] We have now obtained confirmation of this assignment by subjecting desmethylherqueichrysin to prolonged treatment with pyridine hydrochloride at 220°, when it is partially converted into atrovenetin (6; R' = R^2 = H). In the light of this result we have re-investigated some earlier experiments[1] which at the time led us to exclude structure (4; R = H) for desmethylherqueichrysin.

In our previous communication[1] we described the monomethylation of the phenalenone (2), which was itself prepared by Claisen Rearrangement of the dimethylallyl ether (1).[4] The methylation product was assigned structure (3) on the assumption that the strongly-chelated 9-hydroxy group of the phenalenone (2) would be resistant to methylation. Subsequent cyclisation and demethylation gave material, then thought to have structure (4; R = H), which was not identical with desmethylherqueichrysin. We now report that the major product obtained by methylation of the trimethyl ether (2) with diazomethane, previously formulated as the tetramethyl ether (3), is in fact correctly represented by the revised structure (5). Preferential alkylation of the strongly chelated 9-hydroxy group may be ascribed to the severe steric hindrance imposed on the 3-hydroxy group. The alternative structure (10) for the tetramethyl ether is excluded by the fact that heating under reflux with methyl iodide and silver oxide affords the 1,3-diketone (9: R = Me), the structure of which follows from the close correspondence of its spectra with those of the known compound (9; R = $CMe_2.CH{:}CH_2$).[4] The only other products formed were the iodo-ethers (7) and (8). The failure of the 3-hydroxyphenalenone (5) to undergo O-methylation under the conditions employed is a further consequence of the steric hindrance already noted.

Treatment of compound (5) with p-toluenesulphonic acid affords the corresponding



dihydrofuran derivative (6; R' = R^2 = Me), a hitherto unknown tetramethyl ether of atrovenetin, which is smoothly demethylated with hydriodic acid to yield (±)-atrovenetin (6; R' = R^2 = H). Since the tetramethyl ether (6; R' = R^2 = Me) is not identical with atrovenetin tetramethyl ether B [previously formulated[3] as either (6; R' = R^2 = Me) or (11)] it follows that the latter is correctly represented by structure (11).

During the present investigation we have succeeded in isolating as a minor product from the methylation of the phenalenone (2) a tetramethyl ether to which structure (3) may correctly be applied. This compound exhibits, in its n.m.r. spectrum, hydroxyl absorption at very low field (τ -8,7), characteristic of a 9-hydroxyphenalenone, and upon treatment with p-toluenesulphonic acid it is converted into the tetracyclic compound (4; R = Me). Demethylation with hydrogen iodide gives (±)-desmethylherqueichrysin (4; R = H), which exhibits IR, UV, and NMR spectra and t.l.c. behaviour identical with those recorded for the same material derived from a natural source.

REFERENCES

1. D.A. Frost and G.A. Morrison, Tetrahedron Letters., 1972, 4729.
2. N. Narasimhachari and L.C. Vining, J. Antibiot., 1972, 25, 155.
3. D.H.R. Barton, P. de Mayo, G.A. Morrison, and H. Raistrick, Tetrahedron, 1959, 6, 48; I.C. Paul, G.A. Sim, and G.A. Morrison, Proc. Chem. Soc., 1963, 352; I.C. Paul and G.A. Sim, J. Chem. Soc., 1965, 1097.
4. D.A. Frost and G.A. Morrison, J. Chem. Soc. Perkin I, 1973, 2388.