THE LIPID METABOLISM OF PLANTS

A thesis presented in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Biochemistry at Massey University.

by

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1968

ABSTRACT

A method, based on the isolation of pure compounds by a combination of DEAE-cellulose and thin-layer chromatography, has been developed for the rapid and quantitative estimation of the major glycerolipids of plant tissues. The method has been used 1) for the analyses of the major glycerolipids of a wide variety of plant species and 2) as part of a detailed chromatographic analysis of the glycerolipid constituents of the green alga Mesotaenium caldariorum during which two unknown lipids, probably glycerolipids, were isolated.

On the basis of the incorporation of radiocarbon from ^{14}C-labelled precursors into the glycerolipids of both Mesotaenium cells and pumpkin leaves, the likelyhood of relatively low turnover rates for the various glycerolipids, with the possible exceptions of phosphatidyl glycerol in Mesotaenium and phosphatidyl choline in pumpkin leaf, is discussed.

The unusual growth requirements of Mesotaenium caldariorum in liquid culture is discussed briefly.

PREFACE

In this study, a considerable amount of time has been spent on the development of techniques for the routine separation and analysis of all of the major glycerolipids of plant tissues. These techniques were considered an essential prerequisite for obtaining the type of results envisaged in the planning of the topic. Time limitations have subsequently dictated that a lesser period than would have been desired was available for metabolic studies, so that the isotope incorporation experiments reported here should be regarded as preliminary in nature. Nonetheless, these experiments do point the way for further investigations which could provide reliable measurements of the turn-over of the individual glycerolipids of algae and leaves.

I wish to express my appreciation to Professor R.D. Batt for his advice and guidance during the course of this work and to Dr K.J. Mitchell for his constant encouragements. To Dr A.O. Taylor go my thanks for his patience and attentiveness during our discussions of some aspects of this work.

I am indebted to the Department of Scientific and Industrial Research for ensuring me employment at the Plant Physiology Division of the Department while this investigation was carried out.

P.G. Roughan.

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PART 1

THE IDENTIFICATION, SEPARATION AND ANALYSIS OF PLANT GLYCEROLIPIDS

PUBLICATIONS arising from material in this thesis.

1. Simple devices for the application of samples as narrow streaks for thin-layer chromatography.

   P.G. Roughan and C.G. Tunnicliffe (1967).

   J. Lipid Res. 8; 511.

2. Quantitative analysis of sulfolipid (sulfoquinovosyl diglyceride) and galactolipids (monogalactosyl and digalactosyl diglycerides) in plant tissues.

   P.G. Roughan and R.D. Batt (1968).

   Anal. Biochem. 22; 74.

3. The glycerolipid composition of leaves.

   P.G. Roughan and R.D. Batt (1969).

   Phytochemistry, 8; In Press.