STRUCTURE AND PHYSIOLOGY OF *PARIS*-TYPE ARBUSCULAR MYCORRHIZAS

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TABLE OF CONTENTS

ABSTRACT

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The overall aim of the work presented in this thesis was to increase our understanding of the morphology and physiology of *Paris*-type arbuscular mycorrhizas (AM).

Preliminary experiments were conducted to select a *Paris*-type AM suitable for glasshouse based experiments. A range of plant species were inoculated with AM fungi and their morphology assessed quantitatively. *Asphodelus fistulosus* when colonised by *Glomus coronatum* formed a *Paris-type* AM and was selected for use in the majority of the experiments in the thesis.

The time-course of development of the *A. fistulosus*/*G. coronatum* symbiosis was investigated. The mathematical relationships, or interdependence between the different structures was determined using a new method of colonisation assessment, the Interdependence Magnified Intersects Technique (IMIT). The time-course of development was slower than that of the *Arum-type* AM, supporting observations from field based studies. The IMIT revealed distinct interactions between the different structures.

The morphology and effect of *Paris-type* structures formed by *G. coronatum* when colonising *A. fistulosus* on the size and position of plant cortical cell nuclei were investigated using Laser Scanning Confocal Microscopy

(LSCM). Effects on the plant nuclei in cells containing arbusculate coils (AC) were similar to those observed in cells containing arbuscules of *Arum*-type AM. LSCM allowed for clear observation of these effects and of the morphology of *Paris-type* structures in general.

The growth and phosphorus (P) nutrition of *A. fistulosus* colonised by *G. coronatum* grown in soil with five different soil P concentrations was investigated, providing the first laboratory based assessment of the P nutrition of a *Paris*-type AM. The *A. fistulosus*/*G. coronatum* symbiosis was functional in terms of its effects on plant growth and P nutrition of the plant. There were significant effects of soil P concentration on the functioning of the symbiosis with important implications for the growth and survival of *A. fistulosus*.

In the final experiment, the importance of AM fungal identity in defining the morphology of AM was investigated using a range of Glomalean fungi colonising *Lycopersicon esculentum*. When colonising *L. esculentum* some AM fungi formed the *Arum*-type and others formed the *Paris*-type. The results challenge the traditional view that AM morphology is mainly under the control of the plant and provides a valuable opportunity unravel the significance of structural diversity in AM.

The research presented in this thesis has increased our knowledge of *Paris*-type AM and presents some new and exciting research opportunities.