



**STRUCTURE AND PHYSIOLOGY OF *PARIS*-TYPE
ARBUSCULAR MYCORRHIZAS**

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TABLE OF CONTENTS

TABLE OF CONTENTS	ii
LIST OF FIGURES	viii
LIST OF TABLES	xiii
ABSTRACT	xvi
PUBLICATIONS DURING CANDIDATURE	xviii
DECLARATION	xix
ACKNOWLEDGEMENTS	xx
CHAPTER 1 INTRODUCTION AND REVIEW OF LITERATURE	1
1.1 Introduction	1
1.2 The role of mycorrhizas	3
1.2.1 Benefits to the symbionts: an overview	3
1.3 Morphology and development of arbuscular mycorrhizas	5
1.3.1 Sources of inoculum	5
1.3.2 Pre-colonisation events	6
1.3.3 Contact and penetration of roots	7
1.3.4 Internal phases of colonisation	8
1.4 Control of arbuscular mycorrhizal morphological types	16
1.5 Absence of arbuscules in arbuscular mycorrhizas	19
1.6 Time-course of development	20
1.7 Cellular development and Laser Scanning Confocal Microscopy	23
1.8 Phosphorus and arbuscular mycorrhizas	25

1.8.1	Effects of phosphorus on plant growth: mechanisms of uptake, translocation and transfer _____	25
1.8.2	Effects of phosphorus on colonisation _____	28
1.9	Conclusions and aims _____	30
CHAPTER 2 GENERAL MATERIALS AND METHODS _____		32
2.1	Soils _____	32
2.2	Plant material _____	33
2.2.1	Seed sources and germination _____	33
2.2.2	Watering and nutrient addition _____	34
2.2.3	Glasshouse conditions _____	35
2.3	Fungal material _____	35
2.3.1	Fungal isolates _____	35
2.3.2	Inoculum maintenance and production _____	37
2.3.3	Nurse-pot production _____	37
2.4	General methods _____	38
2.4.1	Harvesting _____	38
2.4.2	Soil phosphorus determination _____	39
2.4.3	Plant tissue phosphorus determination _____	40
2.4.4	Clearing and staining of roots _____	41
2.4.5	Assessment of colonisation _____	41
2.4.5.1	Grid line intersect method _____	41
2.4.5.2	Magnified Intersects Technique _____	42
2.4.6	Sectioning of plant material _____	43
2.4.7	Statistical analysis _____	44
CHAPTER 3 SELECTION OF A PARIS-TYPE AM _____		45

3.1	Introduction	45
3.2	Materials and methods	47
3.2.1	Plant species and germination	47
3.2.2	Timing of harvests	49
3.3	Results	50
3.3.1	<i>Linum usitatissimum</i>	50
3.3.2	<i>Viola cornuta</i>	53
3.3.4	<i>Asphodelus fistulosus</i>	56
3.3.5	<i>Cyperus rotundus</i>	57
3.4	DISCUSSION	57
CHAPTER 4 EFFECT OF PHOSPHORUS ON THE DEVELOPMENT OF THE <i>ALLIUM PORRUM</i>/ <i>SCUTELLOSPORA CALOSPORA</i> SYMBIOSIS		62
4.1	Introduction	62
4.2.1	Plant growth	64
4.3	Results	65
4.3.1	Colonisation	65
4.3.2	Plant growth	69
4.4	Discussion	72
4.4.1	Colonisation	72
4.4.2	Plant growth	76
4.5	Conclusions	78
CHAPTER 5 THE INTERDEPENDENCE MAGNIFIED INTERSECTS TECHNIQUE (IMIT): TIME-COURSE OF DEVELOPMENT OF <i>ASPHODELUS FISTULOSUS</i>/<i>GLOMUS CORONATUM</i> SYMBIOSIS		80

5.1	Introduction	80
5.2	Materials and methods	83
5.2.1	Plant growth & harvesting	83
5.2.2	Determination of spatial separation of coil types	84
5.2.3	A new method for the assessment of colonisation: the Interdependence, Magnified Intersects Technique (IMIT)	84
5.2.4	Modelling of Interdependence Magnified Intersects Technique data	86
5.3	Results	90
5.3.1	Plant growth	90
5.3.2	Morphology and location of hyphal coils and arbusculate coils in the inner and outer cortex	92
5.3.3	Time-course of development	95
5.3.4	Selection of model for assessing interdependence over time	97
5.3.5	Interdependence	98
5.4	Discussion	104
5.4.1	Plant growth	104
5.4.2	Morphology and location of HC and AC in the inner and outer cortex	105
5.4.3	Time-course of development	106
5.4.4	The Interdependence Magnified Intersects Technique	108
5.5	Conclusions	111
 CHAPTER 6 LASER SCANNING CONFOCAL MICROSCOPY OF ASPHODELUS FISTULOSUS/GLOMUS CORONATUM SYMBIOSIS: THREE-DIMENSIONAL ANALYSIS OF PLANT NUCLEAR SHIFT		
6.1	Introduction	112
6.2	Materials and methods	115

6.2.1	Plant growth	115
6.2.2	Laser Scanning Confocal Microscopy	115
6.2.3	Measurements	116
6.3.	Results	120
6.3.1	Development of the symbiosis	120
6.3.3	Fungal nuclei	126
6.4.	Discussion	127
6.4.1	Development of the symbiosis	127
6.4.2	Position and volume of the plant nuclei	127
6.4.3	Fungal nuclei	131
6.5	Conclusions	131
 CHAPTER 7 EFFECT OF SOIL P CONCENTRATION ON GROWTH AND PHYSIOLOGY OF ASPHODELUS FISTULOSUS/GLOMUS CORONATUM SYMBIOSIS		
7.1	Introduction	133
7.2	Materials and methods	135
7.2.1	Plant growth and phosphorus treatments	135
7.2.2	Calculations and data analysis	136
7.3	Results	137
7.3.1	Colonisation	137
7.3.2	Plant growth	138
7.3.3	Plant phosphorus	142
7.4	Discussion	147
7.4.1	Colonisation	147
7.4.2	Plant growth	148

7.5	Conclusions _____	153
CHAPTER 8 THE INFLUENCE OF FUNGAL IDENTITY ON		
ARBUSCULAR MYCORRHIZAS FORMED BY <i>LYCOPERSICON</i>		
<i>ESCULENTUM</i> _____		
155		
8.1	Introduction _____	155
8.2	Materials and methods _____	156
8.2.1	Plant growth, harvesting and colonisation _____	156
8.3	Results _____	158
8.3.1	Total colonisation _____	158
8.3.2	Colonisation morphology _____	158
8.4	Discussion _____	165
8.5	Conclusions _____	172
CHAPTER 9 GENERAL DISCUSSION _____		
174		
9.1	Introduction _____	174
9.2	Discussion _____	174
Stage 1	Selection of a suitable <i>Paris</i> -type arbuscular mycorrhiza _____	174
Stage 2	Morphological development & functioning of <i>Paris</i> -type arbuscular mycorrhizas 176	
Stage 3	The role of fungal identity on the morphology of arbuscular mycorrhizas _____	180
9.4	Future Research _____	182
APPENDICES _____		
185		
REFERENCES _____		
189		

ABSTRACT

STRUCTURE AND PHYSIOLOGY OF *PARIS*-TYPE ARBUSCULAR MYCORRHIZAS

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.