

ECTOMYCORRHIZAS OF SOME
AUSTRALIAN PLANTS

by

Harry H. Kope

B.Sc. (Ag.)

Alberta

A dissertation submitted to The University of Adelaide
in fulfilment of the requirements for the degree of
Master of Agricultural Science

Department of Plant Pathology
Waite Agricultural Research Institute
The University of Adelaide
South Australia

April, 1984

TABLE OF CONTENTS

	<i>Page No.</i>
<i>DECLARATION</i>	IV
<i>ACKNOWLEDGEMENTS</i>	V
<i>SUMMARY</i>	VI
INTRODUCTION	1
MATERIALS AND METHODS	4
The fungi	4
Seed	4
Soil mix	7
Inoculation	9
Harvesting	9
Terminology and definitions employed	10
MORPHOLOGICAL STUDIES OF MYCORRHIZAS	12
Ectomycorrhizas of <u>Eucalyptus maculata</u>	13
<u>E. maculata</u> + <u>Labyrinthomyces</u> sp.	14
<u>E. maculata</u> + <u>Peziza whitei</u>	14
<u>E. maculata</u> + <u>Amanita grisea</u>	16
<u>E. maculata</u> + <u>Laccaria ohiensis</u>	16
Ectomycorrhizas of herbs and shrubs	20
1. <u>Poranthera microphylla</u>	20
<u>P. microphylla</u> + <u>L. ohiensis</u>	20
<u>P. microphylla</u> + <u>P. whitei</u>	23
<u>P. microphylla</u> + <u>Labyrinthomyces</u> sp.	25
2. <u>Angianthus tomentosus</u>	27
<u>A. tomentosus</u> + <u>L. ohiensis</u>	27
<u>A. tomentosus</u> + <u>P. whitei</u>	28
<u>A. tomentosus</u> + <u>Labyrinthomyces</u> sp.	30

II

3. <u>Waitzia citrina</u>	32
<u>W. citrina</u> + <u>L. ohiensis</u>	32
<u>W. citrina</u> + <u>P. whitei</u>	33
4. <u>Stylidium graminifolium</u>	35
<u>S. graminifolium</u> + <u>Labyrinthomyces</u> sp.	36
5. <u>Pultenaea obovata</u>	39
<u>P. obovata</u> + <u>L. ohiensis</u>	39
<u>P. obovata</u> + <u>P. whitei</u>	40
<u>P. obovata</u> + <u>Labyrinthomyces</u> sp.	41
6. <u>Gompholobium latifolium</u>	43
<u>G. latifolium</u> + <u>L. ohiensis</u>	43
COMPARISON OF THE MYCORRHIZAS	46
DEVELOPMENTAL STUDIES AND GROWTH RESPONSES OF SOME ECTOMYCORRHIZAL HERBS	52
DISTRIBUTION OF MYCORRHIZAS ON ROOT SYSTEMS	53
GROWTH RESPONSES OF MYCORRHIZAL PLANTS	57
DISCUSSION	61
GENERAL DISCUSSION	62

APPENDICES	66
Appendix I	66
Formulae for media	
Appendix II	68
Morphology of the mycorrhiza of <u>Pinus radiata</u> with <u>Amanita muscaria</u>	
Appendix III	69
Change in the mean shoot dry weight and the logarithm of shoot dry weight	
III A <u>P. microphylla</u> + <u>Labyrinthomyces</u> sp.	69
III B <u>P. microphylla</u> + <u>P. whitei</u>	70
III C <u>W. citrina</u> + <u>L. ohioensis</u>	71
III D <u>W. citrina</u> + <u>P. whitei</u>	72
III E <u>A. tomentosus</u> + <u>P. whitei</u>	73
Appendix IV	74
Percentage of mycorrhizal versus non-mycorrhizal roots of different orders at 3 sampling times	
IV A <u>P. microphylla</u> + <u>Labyrinthomyces</u> sp.	74
IV B <u>P. microphylla</u> + <u>P. whitei</u>	75
IV C <u>W. citrina</u> + <u>L. ohioensis</u>	76
IV D <u>W. citrina</u> + <u>P. whitei</u>	77
IV E <u>A. tomentosus</u> + <u>P. whitei</u>	78
BIBLIOGRAPHY	79

DECLARATION

I hereby declare that this thesis contains no material which has been accepted for award of any other degree or diploma in any university. To the best of my knowledge and belief, no material described herein has been previously published or written by another person except when due reference is made in the text.

I give consent to this copy of my thesis, when deposited in the University Library, being available for loan and photocopying.

HARRY H. KOPE

27/4/84

DATE

ACKNOWLEDGEMENTS

I wish to thank Dr. J.H. Warcup, my supervisor, for his guidance and constructive criticism during the preparation of this thesis.

I also wish to thank the members of the Plant Pathology Department all of whom helped me in various ways and in particular, Professor H.R. Wallace, for the provision of facilities during this study.

I thank Marjo Francis for her help in typing the thesis.

I thank my wife, Beth, for her patience and encouragement.

SUMMARY

The morphology and development of ectomycorrhizas formed by Peziza whitei, Labyrinthomyces sp. (Ascomycetes) and Laccaria ohiensis (Basidiomycete) on a range of hosts including Eucalyptus maculata (tree), Pultenaea obovata, Gompholobium latifolium (shrubs) and Poranthera microphylla, Angianthus tomentosus, Waitzia citrina and Stylidium graminifolium (herbs) have been studied in pure culture synthesis in a soil mix low in available phosphate.

The associations formed varied from mycorrhizas with well defined sheaths enclosing root apices on E. maculata, P. obovata and G. latifolium to less defined ones on the herbs where associations varied from partial sheathing of roots to discrete patches of fungal sheath to no sheath at all in the association A. tomentosus with P. whitei. A Hartig net was formed in most associations though Laccaria ohiensis formed an irregular one with E. maculata and none with P. microphylla, A. tomentosus and W. citrina. The results showed that the form of a mycorrhiza depended on both partners, not fungus or higher plant alone.

Compatibility of some plant-fungus combinations was indicated by study of the development of mycorrhizas over time. A high percentage of roots of all orders became mycorrhizal and the percentage remained high as root numbers and orders increased.

All plant-fungus combinations, except A. tomentosus with L. ohiensis, showed a significant growth response compared with uninoculated plants which indicated mycorrhizal effectiveness, irrespective of mycorrhizal form, in the growth conditions employed.