# TABLES OF CONTENTS

ABSTRACT	ii-iii
ACKNOWLEDGMENTS	iv-v
DECLARATION	vi
LIST OF ABBREVIATIONS	vii-viii
LIST OF PLATES	ix
TABLES OF CONTENT	x-xvi
CHAPTER I	
GENERAL INTRODUCTION	2-3
CHAPTER II	
LITERATURE REVIEW	5-58
2.1 Groundnut: Taxonomy, history, origin and classification	5-8
2.2 Worldwide groundnut production of groundnut	8-10
2.3 Groundnut in Republic of India	10-11
2.4 Groundnut in Maharashtra	12-13
2.4.1 Ground constraints	13-14
2.4.2 Disease management	14-15
2.4.3.1 Host resistant	15
2.4.3.2 Cultural practices	15-16
2.4.3.3 Biological control	16-18
2.4.3.4 Pesticides of plant origin	18-19
2.4.3.5 Chemical methods	19-20
2.4.3.6 Integrated disease management	20
2.4.3.7 Future prospects	20
2.5 Importance of groundnut	21
2.5.1 Use	21
2.5.2 Health benefits	21-22
2.5.3 Medicinal value	22-24
2.5.4 Nutritional value	24-25

2.6 Groundnut stem-rot caused by fungus Sclerotium rolfsii	25
2.6.1 History, host range and distribution	25-26
2.6.2 Epidemiology and ecology	26-28
2.6.3 Sclerotium rolfsii: pathogenicity and infection of the host tissue	28-29
2.6.4 Biological control of Sclerotium rolfsii using Glomus fasciculatur	m
and Trichoderma.	30-31
2.7 Groundnut charcoal root-rot caused by Macrophomina phaseolina	a
2.7.1 History, nomenclature, host range and distribution	32-33
2.7.2 Epidemiology and ecology	33-34
2.7.3 Infection of the host tissue and pathogenicity	34-35
2.7.4 Biological control of Macrophomina phaseolina using Glom	us
fasciculatum and Trichoderma	35-37
2.8 The fungus Trichoderma	
2.8.1 History	37
2.8.2 Biology and Nomenclature	37-38
2.8.3 Morphology and characteristics of the genus Trichoderma	38
2.8.4 Medium of growth and sporulation	39
2.8.5 Ecology	39
2.8.6 Mode of action of Trichoderma	40
2.8.6.1 Mycoparasitism	40
2.8.6.2 Antibiosis	40-41
2.8.6.3 Competition	41
2.8.6.4 Induced defense resistance	41-42
2.8.6.5 Enzymes	42
2.8.7 Trichoderma as biocontrol agent with formulation	42-43
2.8.8 Pathogen control by using T. viride	44-45
2.9 Arbuscular Mycorrhizal Fungus	45
2.9.1 Definition and history	45-46
2.9.2 Classification	46
2.9.3 Life cycle	47-48
2.9.4 Phosphate nutrition	48-49
2.9.5 AM and rhizosphere microorganisms	49-50
2.9.6 Types of interaction	50-51
2.9.7 Arbuscular mycorrhizae fungi in disease control	52-54

2.9.8 Mechanism employed by AM association	54-57
2.10 Objectives of present research	57
CHAPTER III	
IN VITRO EFFICACY OF TRICHODERMA VIRIDE AGAINST S	OIL-BORNE
ROOTS PATHOGENS SCLEROTIUM ROLFSII AND MACK	ROPHOMINA
PHASEOLINA.	58-68
3.1 Material and methods	59
3.1.1 Collection of fungal isolates and culture maintenance	59
3.1.2 Antagonists	60
3.1.3 Potato Dextrose Agar (PDA) medium	60
3.1.4 Sterilization	60
3.1.5 Inoculating tools	61
3.1.6 Mycelial growth rate	61
3.1.7 Percent growth inhibition	61
3.1.8 In vitro antifungal activities of Trichoderma isolates aga	ainst major
pathogens (S. rolfsii and M. phaseolina) of groundnut pl	ant in dual
culture interaction	62
3.1.9 Statistical analysis	62
3.2 Results	63
3.2.1 The antifungal activities of <i>Trichoderma</i> isolate	63
3.2.2 Inhibition of radial growth	63
3.2.3 Mycelial growth rate (Average Linear Growth)	64-65
3.2.4 The growth rate of fungal isolates in vitro	65
3.3 Discussion	67-68
CHAPTER IV	
EFFECT ON GROWTH OF DIFFERENT GROUNDNUT CULT	
TO GLOMUS FASCICULATUM INOCULATION (SINGLY) AN	
17.Bereelli e.i.	MBINATION
TREATMENT AGAINST PATHOGEN SCLEROTIUM ROLFS. STEM-ROT.	71-109

4.1 Materials and methods	72
4.1.1 Soil characteristics	72
4.1.2 Study site	73
4.1.3 Microbial inoculants	73
4.1.4 Isolation and preparation of AM fungal inoculum	74
4.1.5 Quantification of AM	74-75
4.1.6 Plant material	74
4.1.7 Pre-treatment of seeds	74
4.1.8 Fungal pathogen isolates	75
4.1.9 Preparation of S. rolfsii inoculum	75-76
4.1.10 Artificial production of sclerotia in controlled environment	75
4.1.11 Inoculation techniques	76
4.1.12 Preparation of M. phaseolina inoculum	76
4.1.13 Evaluation of biocontrol ability by biological control agents	s Glomus
fasciculatum against pathogens Sclerotium rolfs	sii and
Macrophomina phaseolina in pot culture assay	76
4.1.14 Planting and growth conditions in greenhouse and experiment	ental
design	77
4.1.15 Inoculation with Glomus fasciculatum	77
4.1.16 Treatments	77-79
4.1.17 Pathogenicity test	79
4.1.18 Sampling and harvesting	79
4.1.19 Investigation of growth and yield	79
4.1.20 Determination of disease incidence and severity caused by	pathogen
(Sclerotium rolfsii and Macrophomina phaseolina)	80-81
4.1.21 Determination of root colonization in AM colonized roots	81
4.1.22 Determination of Mycorrhizal Dependency in AM colonized	
4.1.23 Physiological and Biochemical Methods	81-88
4.1.24 Total chlorophyll	81-82
4.1.25 Protein	82-83
4.1.26 Proline	83-84
4.1.27 Total phenols	84- 85
4.1.28 Assay of antioxidant enzymes	85
1 1 28 1 Perovidase	85-86

4.2 Results	92-107
4.1.30 Statistical analysis	88
4.1.29.2 Alkaline phosphatase	87-88
4.1.29.1 Acid phosphatases	87
4.1.29 Estimation of Phosphatases	87
4.1.28.3 Superoxide dismutase	86-87
4.1.28.2 Polyphenol oxidase	86

#### **CHAPTER V**

BIOCONTROL OF SCLEROTIUM ROLFSII CAUSING STEM-ROT ON DIFFERENT GROUNDNUT CULTIVARS USING GLOMUS FASCICULATUM AND TRICHODERMA VIRIDE AND THEIR EFFECT ON PHYSIOLOGICAL AND BIOCHEMICAL CHANGES. 110-135

5.1 Materials and methods	111
5.2 Results	111-133

#### **CHAPTER VI**

EFFECT ON GROWTH OF DIFFERENT GROUNDNUT CULTIVARS DUE
TO GLOMUS FASCICULATUM INOCULATION (SINGLY) AND GLOMUS
FASCICULATUM + TRICHODERMA VIRIDE (COMBINATION)
TREATMENT AGAINST PATHOGEN MACROPHOMINA PHASEOLINA
CAUSING CHARCOALROOT-ROT. 136-153

6.1 Materials and methods	137
6.2 Results	137-151

## **CHAPTER VII**

BIOCONTROL OF MACROPHOMINA PHASEOLINA CAUSING CHARCOAL-ROT ON DIFFERENT GROUNDNUT CULTIVARS USING GLOMUS FASCICULATUM AND TRICHODERMA VIRIDE AND THEIR EFFECT ON PHYSIOLOGICAL AND BIOCHEMICAL CHANGES. 154-179

### 7.1 Materials and methods

7.2 Results	155-177
CHAPTER VIII	
GENERAL DISCUSSION	180-192
CHAPTER IX	
EFFICACY OF <i>GLOMUS FASCICULATUM</i> AS BIOCONTROL	AGENT AND
SPACING PATTERN IN FIELD AGAINST PLANT	PATHOGENS
SCLEROTIUM ROLFSII AND MACROPHOMINA PHAS	EOLINA OF
GROUNDNUT.	193-236
9.1 Material and methods	193-198
9.1.1 Field evaluation of <i>Glomus fasciculatum</i>	194
9.1.2 Experimental soil characteristics	194
9.1.3 Field preparation for Experiment	194
9.2 Biological material	195
9.2.1 Plant material	195
9.2.2 Pre-treatment of seeds	195
9.2.3 Glomus fasciculatum inoculum	195
9.3 Pathogen cultures	195
9.3.1 Pathogen inoculum of S. rolfsii and M. phaseolina	195
9.3.2 Planting and growth conditions and experimental design	195
9.3.3 Inoculation technique	196
9.4 Plant treatments	196
9.5 Data collection	196-197
9.5.1 Disease Incidence	197
9.5.2 Disease severity	197
9.5.3Pathogenicity test	197
9.5.4 Determination of root colonization	197
9.5.5 Mycorrhizal dependency:	197
9.5.6 Production Loss	197-198
9.5.7 Total chlorophyll (Arnon, 1949):	198

9.5.8 Statistical analysis

198

9.2 Results	199-225
9.3 Discussion	226-228
CHAPTER X	
EFFECT ON THE RESPONSE OF	F GROUNDNUT CULTIVAR DUE TO
MYCORRHIZAL INOCULATION	AND CAPRICIOUS PHOSPHOROUS
APPLICATION.	237-249
10.1 Material and methods	238
10.2 Phosphate addition	238
10.3 Results	238-245
10.4 Discussion	245-247
11.1 CONCLUSION	250-251
CHAPTER XI	
LITERATURE CITED	250-314