

MASTER'S THESIS

The role of mycorrhizae associated with vetiveria zizaniodes and cyperus polystachyos in the remediation of metal (lead and zinc) contaminated soils

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**The Role of Mycorrhizae Associated with
Vetiveria zizaniodes and *Cyperus polystachyos* in the
Remediation of Metal (Lead and Zinc) Contaminated Soils**

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Abstract

Mycorrhizae are fungi known to associate with the rhizosphere of most vascular plants. The principle advantages of such association are enhanced water and mineral uptake for the infected plant, especially beneficial under the conditions of low moisture and nutrient contents. They are also believed to play important roles in phytoremediative processes. The present study aims to investigate the effects of mycorrhizae on the growth, nutrient as well as heavy uptake by infected host plant, and the role of mycorrhizae aids in phytoremediation.

The effects of mycorrhizae on growth, nutrient and metal uptake by host plants were investigated in a greenhouse trial using Vetiver grass (*Vetiveria zizanioides*) and Many-spike flatsedge (*Cyperus polystachyos*). Inoculation of mycorrhizae significantly increased the growth as well as nutrient uptake of both plant species. The colonization of mycorrhizae increased Pb and Zn uptake by plants under lower metal concentrations (at 0 and 10 mg/kg of Pb or Zn), while decreased Pb and Zn uptake under higher metal conditions (at 100 and 1000 mg/kg of Pb or Zn). When *G. mosseae* was inoculated with *C. polystachyos*, a high positive correlation was found between the mycorrhizal colonization with metal concentrations, Pb: $r=0.9496$ and Zn: $r=0.9901$. Moreover, *C. polystachyos* had a dependency ($p<0.05$) on mycorrhizae for growth than *V. zizanioides*. In addition, P concentration in soil was negatively correlated with mycorrhizal colonization as well as metal concentrations.

A field study in Pb/Zn mine tailings was conducted to investigate the influence of mycorrhizae on phytoremediation of Pb/Zn contaminated soils. The of increase in plant biomass, Pb and nutrient uptakes in shoot of mycorrhizal *V. zizanioides* is more pronounced with the aid of organic amendment than mycorrhizal plants growing on tailings alone. However, uptake of Zn and Cu by shoot depends more on organic amendment than mycorrhizal inoculation. These findings may provide a clue for phytoremediation of soils contaminated by high concentrations of heavy metals.

Plants are protected from the potential toxicity caused by Pb and Zn by inoculation with mycorrhizae, but the degree of protection varies according to the fungus and host plant combination. It seems clear that AM can play an essential role in the restoration of contaminated soils, by protecting the plants from high levels of heavy metals and that this effect can be partially due to improvement of the P status of the plant.

Reduction in metal uptake of plants associated with mycorrhizae may be undesirable in terms of phytoremediation of metal polluted soils. However, with the inoculation of mycorrhizae, the total metal uptake by the whole plant is increased due to the overall increase in biomass of host plants. It can be concluded that mycorrhizae might play an essential role in phytoremediation. The efficiency depends on suitable host plant-fungus combination as well as organic amendment.

Tables of Contents

	Page
Declaration	i
Abstract	ii
Acknowledgements	iii
Table of Contents	iv
Lists of Tables	vii
Lists of Figures	ix
Chapter I. Introduction	
1.1 Mycorrhizae (overview)	1
1.2 Eco-function	2
1.3 Frontal research areas	3
1.3.1 Basis of root colonization and symbiont establishment	4
1.3.2 Cost and benefits in mycorrhizal systems	5
1.4 Mineral Acquisition by Arbuscular Mycorrhizal Plants	6
1.4.1 Phosphorus	8
1.4.2 Nitrogen	11
1.4.3 Potassium, Calcium, Magnesium and Sodium	13
1.4.4 Zinc and Copper	14
1.4.5 Cadmium and Lead	17
1.5 Mycorrhizae and Metal Toxicity	19
1.6 Mycorrhizae and Phytoremediation	
1.6.1 Phytoremediation	24
1.6.2 Phytoaccumulation	24
1.6.3 Hyperaccumulation	26
1.6.4 Limitation of phytoremediation	27
1.6.5 Role of mycorrhizae (arbuscular mycorrhizae) in phytoremediation	28
1.7 Aim and Objectives of the research	32
Chapter II. Ecological survey on mycorrhizae in local plant species	
2.1 Introduction	34
2.2 Site descriptions	36
2.3 Plant descriptions	37
2.4 Methods	
2.4.1 Collection and preparation of root samples from field sites	40
2.4.2 Collection and preparation sediment samples from field sites	41

2.4.3	Preparation for staining and colonization estimation	41
2.5	Results	
2.5.1	Soil analysis	44
2.5.2	Mycorrhizal colonization percentage	46
2.6	Discussion	48
2.7	Conclusion	53

Chapter III. The role of mycorrhizae associated with *Vetiveria zizanioides* and *Cyperus polystachyos* for remediating Pb/Zn contaminated soils: Greenhouse study

3.1	Introduction	54
3.2	Materials and methods	
3.2.1	Soil preparations	56
3.2.2	Plant species	56
3.2.3	Mycorrhiza inocula	56
3.2.4	Chemical analysis	57
3.2.5	Statistical analyses	59
3.3	Results	
3.3.1	Soil properties	59
3.3.2	Mycorrhizal infections	64
3.3.3	Plant analysis	
3.3.3.1	Dry weights	69
3.3.3.2	Mycorrhizal dependency	69
3.3.3.3	Metal concentrations in plant tissues	75
3.3.3.4	Nutrient content	85
3.3.3.5	Relationship between P and metal (Pb and Zn) concentrations in shoot	88
3.4	Discussion	
3.4.1	The dependency on mycorrhizae varies among plant species	92
3.4.2	Mycorrhizal infection depends on plant host rather than soil metal concentrations	92
3.4.3	Relationships between metal concentrations and P uptake by plants	93
3.4.4	The influence of mycorrhizae on metal uptake	95
3.5	Conclusion	96

Chapter IV. The role of mycorrhizae associated with *Vetiveria zizanioides* growing on lead/zinc mine tailings: field trial

4.1	Introduction	97
4.2	Site descriptions	99
4.3	Plot preparation	99
4.4	Treatments	100
4.5	Chemical analysis	
4.5.1	Tailings	106

4.5.2	Plant analysis	106
4.5.3	Mycorrhizal analysis	107
4.6	Statistical analyses	107
4.7	Results	
4.7.1	Soil analysis	108
4.7.2	Mycorrhizal infections	109
4.7.3	Plant analysis	
4.7.3.1	Dry weights	113
4.7.3.2	Metal concentrations in plant tissues	116
4.7.3.3	Nutrient contents in plant tissues	118
4.7.3.4	Relationship between metal uptake and shoot dry weight	120
4.8	Discussion	
4.8.1	Soil properties and mycorrhizal colonization	123
4.8.2	Soil metal concentrations and mycorrhizal colonization	124
4.8.3	Plant metal concentrations	124
4.8.4	Relationship between mycorrhizal colonization, plant biomass and total metal uptake in plant tissue	126
4.8.5	Total nitrogen, phosphorus and potassium contents in plant tissues	127
4.9	Conclusion	129
Chapter V. General Discussion and Conclusion		
5.1	Factors affecting mycorrhizal colonization	130
5.2	Effects of mycorrhizal on plant growth and nutrient uptake	131
5.3	The influence of mycorrhizal on metal uptake by plant	132
5.4	Cost efficiency of mycorrhizal symbiosis for phytoremediation	132
5.5	General conclusion	133
5.6	Comments on future studies	134
	References	136
	List of present in meetings	149
	Curriculum Vitae	150