ANTAGONISTIC ACTIVITY OF Phomopsis sp. AND Fusarium lateritium AGAINST THREE TREE PATHOGENS

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ANTAGONISTIC ACTIVITY OF *Phomopsis* sp. AND *Fusarium lateritium* AGAINST THREE TREE PATHOGENS

By

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A Project Report Submitted in Partial Fulfilment of the Requirements for the Degree of Bachelor of Forestry Science in the

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DEDICATION

Specially dedicated to my:

Mother and Father

Brothers and Sisters

Prof. Dr. Rozi Mohamed

Faculty of Forestry

Thank you for your encouragements, motivation and supports

And the sacrifices that you have given.

Thank you for everything. May God bless all of us.

ABSTRACT

The impact of plant diseases such as brown root rot, wilt, stem and branch cankers, staining of vascular tissues and damping-off has been profound over the centuries. Since the uses of fungicides bring negative impacts to the environment, biological control agent provide the alternative solution to control diseases in an environment-friendly manner. In the present study, the morphology and growth performance of several fungi cultures growing on normal Potato Dextrose Agar (nPDA) and PDA with adjusted pH (7.4) (aPDA) were examined. The growth of *Fusarium oxysporum* was 3-fold faster than *Ceratocystis fimbriata* and 2-fold faster than *Phellinus noxius* on nPDA. The antagonistic activity of endophytic fungi, *Phomopsis* sp. and *Fusarium lateritium* against pathogenic fungi, *F. oxysporum*, *P. noxius* and *C. fimbriata* was evaluated through dual culture assay and non-volatile compound test. Based on the results, it was observed that the growth of pathogenic fungi was inhibited strongly by *Phomopsis* sp. compared to *F. lateritium*. This shows that between these two endophytic fungi isolates, *Phomopsis* sp. has potential as a biological control agent against these tested fungal pathogens.

ABSTRAK

Kesan penyakit tumbuhan seperti reput coklat akar, layu, batang dan cankers cawangan, pewarnaan tisu vaskular dan redaman-off telah mendalam di sepanjang zaman. Sejak penggunaan racun kulat membawa kesan negatif kepada alam sekitar, agen kawalan biologi menyediakan penyelesaian alternatif untuk mengawal penyakit dengan cara yang mesra alam. Dalam kajian ini, morfologi dan pertumbuhan prestasi beberapa budaya kulat tumbuh di Potato normal Dextrose Agar (nPDA) dan PDA dengan pH larasan (7.4) (aPDA) telah diperiksa. Pertumbuhan *Fusarium oxysporum* adalah 3 kali ganda lebih cepat daripada *Ceratocystis fimbriata* dan 2 kali ganda lebih cepat daripada *Phellinus noxius* pada nPDA. Aktiviti bermusuhan kulat endofitik, *Phomopsis* sp. dan *Fusarium lateritium* terhadap kulat patogenik, *F. oxysporum*, *P. noxius* dan *Ceratocystis fimbriata* dinilai melalui assay budaya dua dan ujian sebatian yang tidak menentu. Berdasarkan keputusan, ia telah diperhatikan bahawa pertumbuhan kulat patogenik telah menghalang dengan kukuh sebanyak *Phomopsis* sp. berbanding *F. lateritium*. Ini menunjukkan bahawa antara kedua-dua kulat endofitik mengasingkan, *Phomopsis* sp. mempunyai potensi sebagai agen kawalan biologi terhadap ini patogen kulat diuji.

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APPROVAL SHEET

I certify that this research project report entitled “ANTAGONISTIC ACTIVITY OF *Phomopsis* sp. AND *Fusarium lateritium* AGAINST THREE TREE PATHOGENS” by Adeline Augustine has been examined and approved as a partial fulfillment of the requirements for the Degree of Bachelor of Forestry Science in the Faculty of Forestry, Universiti Putra Malaysia.

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LIST OF ABBREVIATIONS

PDA	Potato Dextrose Agar
aPDA	PDA with adjusted pH (7.2-7.4)
nPDA	Normal PDA
FRIM	Forest Research Institute of Malaya
PIRG	Percentage Inhibition of Radial Growth
UPM	Universiti Putra Malaysia

CHAPTER ONE

INTRODUCTION

1.1 General Background

Malaysia is encouraging the development of large-scale commercial forest plantation in order to reduce pressure on the native forest as a source of raw materials and to ensure its continuous availability for the domestic timber industry. Since the 1980s, interest in forest plantation in Malaysia grew rapidly due to the shortage of timber supply from the natural forests. Malaysia has approximately 250 000 hectares under forest plantations (Allard et al., 2003). There are eight tree species recommended by Ministry of Plantation Industries and Commodities Malaysia which include Rubberwood (*Hevea brasiliensis*), *Acacia mangium*, Teak (*Tectona grandis*), Sentang (*Azadirachta excelsa*), Khaya (*Khaya ivorensis* or *Khaya senegalensis*), Kelempayan (*Neolamarckia cadamba*), Batai (*Paraserianthes falcataria*) and Binuang (*Octomeles sumatrana*) for companies to be adopted and entitled as financial support.

All of these plantations are important commodity crop for Malaysia. However, being planted largely as a monocultures plantation is prone to the infestation of plant diseases. Several disease problems have emerged, some of which may become potential threats to the health and productivity of the plantations as it damages the plants by disrupting the plant's physiology, metabolism or direct cellular and tissue damage and the plant's ability to optimize production. With the increase in the area of the plantations, the incidence of

diseases has become a great concern in the country. Pathogens are integral components of forest ecosystems and normally are present at a relatively low density, causing little damage, and having the negligible impact on tree growth and vigour. However, sporadically, in the matter of time or space, some species may grow rapidly to damaging numbers, developing outbreaks which may persist for a variable length of time before subsiding. Such large populations may have adverse effects on many aspects of forests such as tree growth and survival, yield and quality of wood and non-wood products, wildlife habitat, recreation, aesthetics, and cultural value. The impact of pathogens may result in the curtailment of plantation programmes, the abandonment of a given tree species, or the necessity to clear-cut large areas dominated by infested trees.

The impact of forest diseases has been profound over the centuries. The lack of effective quarantine measures coupled with increases in international trade of agricultural and forest products, exchange of plant materials and long-range air travel has resulted in the introduction of pathogens and insects into new environments. These introductions have led to the destruction of indigenous and introduced tree hosts (Palm, 1999).

1.2 Problem Statement

Nowadays, a lot of plantations in Malaysia including Teak (*T*. *grandis*), Rubberwood (*H*. *brasiliensis*), *A*. *excelsa* (Sentang), *A*. *mangium* and oil palm (*Elaeis guineensis*) plantations have been affected by plant diseases such as brown root rot, wilt, stem and branch cankers, staining of vascular tissues and damping-off. These diseases are caused by plant pathogens such as *C*. *fimbriata*, *P*. *noxius,* and *F*. *oxysporum*. Several fungicides are used to control the fungal pathogens, but these activities developed fungicide-resistant strains of the pathogens (Mamgain et al., 2013). Furthermore, uses of chemicals may create an imbalance in the microbial communities which is adverse for the beneficial activity of the microbes. Besides, the application of fungicide also can cause huge environmental problems and ecological disasters (Boland and Hall, 1987). It releases toxic effect on beneficial plants, human's health, land and aquatic animals as the chemicals will run-off from plants and contaminated nearby water and groundwater. It is important to create an alternative for chemical control of plant-pathogens with regard to the protection and environmental aspects of chemicals. To alleviate the fungicide and chemical effect, biological control plays a very important role to improve crop production within the existing resources (Khan et al., 2014). Biological control agents provide the alternative, and a promising solution to control disease in an environment-friendly manner (Mao et al., 1997).

1.3 Objectives

There were two specific objectives that were designed to meet the aim of the study:

1. To examine the growth performance of *Phomopsis* sp., *F. lateritium*, *F. oxysporum*, *P. noxius* and *C. fimbriata* growing on normal Potato Dextrose Agar (nPDA) and PDA with adjusted pH (7.2-7.4pH) (aPDA).
2. To evaluate the antagonistic effect of two endophytic fungi (*Phomopsis* sp. and *F. lateritium)* on three trees pathogen (*F. oxysporum, P. noxius* and *C. fimbriata*) using dual culture assay and non-volatile compound test.

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