ISOLATION OF Ceratocystis-INHIBITING BACTERIA IN Acacia mangium

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ISOLATION OF *Ceratocystis*-INHIBITING BACTERIA IN *Acacia mangium*

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 Faculty of Forestry Universiti Putra Malaysia

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DEDICATION

For my family:
Nornida Idris
Jeffrey Chan Abdullah
Joshua Daniel Chan
Adam Chan
Nugget and Pudding Chan

To my supervisor, Dr Razak Terhem

Not forgetting my friends,
Who gave me encouragement and motivation when I had none,
For anchoring me when I returned from my manic,
For always reaching out a hand to haul me up when I found myself sinking deeper,
For being understanding and patient with me
while I was going through my rough patches,
Especially,
Nur Aisyaa Azman
Nur Suraya Anis Binti Zainal Abidin,
Intan Nur Farisa Binti Mohd Fauzi,
Nur Atiqah Binti Saad,
Muhammad Hafizuddin Bin Rahmat
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ABSTRACT

Acacia mangium is an important plantation species, especially for pulp and paper production, as well as wood composite products. Several pathogen species have been proven to be extremely detrimental to this species in the last 20 years, namely *Ceratocystis* sp., which is fatal in juvenile trees. The aim of this study is to isolate endophyte bacteria in healthy *A. mangium* trees, and to test these isolated endophyte bacteria species against *Ceratocystis* sp. Bacteria exhibiting positive inhibiting abilities would be helpful as a means of future biological control to restore *A. mangium* plantations against it. The roots and leaves of *Acacia mangium* seedlings and trees were sterilized and cultured on 1% Nutrient Agar medium to culture endophyte bacteria. Each bacteria sample obtained was tested against *Ceratocystis* sp. on 1% Potato Dextrose Agar medium. Endophyte bacteria which possessed *Ceratocystis*-inhibiting abilities were successfully isolated, derived mostly from primary root of healthy *Acacia mangium* seedlings. In a total of 50 endophytic bacteria samples, ten endophytic bacteria samples possessing Ceratocystis-inhibiting abilities were successfully isolated.

ABSTRAK

Acacia mangium adalah spesies perladangan penting, terutamanya untuk pengeluaran pulpa dan kertas, serta produk komposit kayu. Beberapa spesies patogen telah membuktikan sangat memudaratkan spesies pokok ini dalam tempoh 20 tahun yang lalu, terutamanya *Ceratocystis* sp., yang membawa maut kepada pokok-pokok juvana. Tujuan kajian ini adalah untuk mengisolasi bakteria endophyte dalam pokok *A. mangium* yang sihat, dan untuk menguji spesies bakteria endophyte ini terhadap *Ceratocystis* sp. Bakteria yang mempamerkan kebolehan menghalang yang positif akan membantu sebagai satu cara kawalan biologi masa depan untuk memulihkan ladang *A. mangium* terhadapnya. Akar dan daun dari pokok matang dan juga anak pokok *Acacia mangium* telah disterilkan dan dibiakkan pada medium 1% Nutrient Agar untuk membiak bakteria endophyte. Setiap sampel bakteria yang diperolehi, diuji terhadap *Ceratocystis* sp. pada medium 1% Potato Dextrose Agar. Bakteria endophyte yang memiliki kebolehan menghalang *Ceratocystis* berjaya diasingkan, dengan kebanyakannya berasal dari akar tunjang *A. mangium* yang sihat. Dalam jumlah 50 sampel bakteria endophyte, hanya sepuluh sampel berjaya menghalang pertumbuhan *Ceratocystis* sp.

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APPROVAL SHEET

I certify that this research project entitled “Isolation of *Ceratocystis*-Inhibiting Bacteria in *Acacia mangium*” by Natasha Deanna Chan Binti Jeffrey Chan has been examined and approved as a partial fulfilment 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

NA	Nutrient Agar
PDA	Potato Dextrose Agar
FRIM	Forest Research Institute of Malaysia
PIRG	Percentage Inhibition of Radial Growth

CHAPTER 1

INTRODUCTION

1.1 Background

Forest plantations in Malaysia have been going through a hard time for the past 30 years. *Pinus* spp. used to be preferred as pulp and paper plantation species, before intended as general utility timber, but was replaced with species such as *Acacia mangium*, *Araucaria* spp., *Eucalyptus* spp., *Gmelina arborea*, *Maesopsis eminii* and *Falcatria molucca*. Likewise, in Sabah, *Pinus* spp. was planted during Sabah Softwoods' establishment, but was halted due to slow growth and seed supply problems, and was replaced with *A. mangium*, *F. moluccana*, *G. arborea* and *Eucalyptus deglupta*. Sabah Forest Industries (SFI) was mostly dependant on hardwood timber from raw natural forest materials, at the same time also planting *A. mangium* and *Eucalyptus* spp., *A. mangium* appeared to be the most promising, based on its stellar performance; superior growth, multiple uses, supposedly lacking of major pest problems and less of a hassle in terms of procuring planting materials. Planted on a 15-year rotation cycle for general utility timber, *A. mangium* was soon dominating most areas of forest plantations under the programme called the Forest Compensatory Programme in Malaysia. No disease problems were detected during the early and immediate young phase of *A. mangium*, yet as they aged they turned out to susceptible to quite a few diseases. The most well-known is heart rot, however root rot and phyllode rust came to light to be even more frightening. As of this, *A. mangium* is no longer a

favoured plantation species in the peninsular, though it is still planted and preferred for pulp and paper production in Sabah and Sarawak.

1.2 Problem Statement

Acacia mangium is a popular plantation species as it is fast-growing, and able to adapt to soils with low fertility. However, the planting of this species is no longer feasible in view of the fast-emerging *Ceratocystis* disease, resulting in wilt canker affecting the stem and root. It is undoubtedly the most serious threat to *Acacia* growers since this species was first introduced in South East Asia 30 years ago. There are three species reportedly affecting *A. mangium*, namely *Ceratocystis adiposa*, *Ceratocystis fimbriata*, and *Ceratocystis manginecans*.

Ceratocystis disease causes wilt and die back in young *A. mangium* plants, most seriously affecting those ranging from six months to two years old. Among symptoms of plants infected with *Ceratocystis* disease are vascular disease, characterized by wilting of foliage, crown dieback, tree death, blackened stem, and patches of foamy exudate on the stem accompanied by a sour fermentation odour. Infected trees are easily recognizable by the presence of distinctive blue-black streaks and lesions under the bark.

1.3 Objective

Thus, in line with the disease affecting the productivity, therefore the objectives of the study were:

1) To isolate endophyte bacteria present in healthy *Acacia mangium*.

2) To isolate *Ceratocystis*-inhibiting bacteria in *Acacia mangium*

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