

**UNIVERSITI TEKNOLOGI MARA**

*Trichoderma asperellum* AS  
**BIOLOGICAL CONTROL AGENT  
FOR CONTROLLING BLACK ROT  
DISEASE OF PINEAPPLE VAR. MD2  
IN MALAYSIA**

**NURUL FARHANA BINTI MAT  
HAYIN**

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## AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

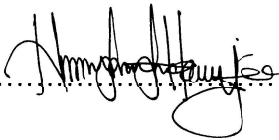
Name of Student : Nurul Farhana Binti Mat Hayin

Student I.D. No. : 2013172759

Programme : Master of Science (Crop Protection) – AT734

Faculty : Plantation and Agrotechnology

Thesis Title : Trichoderma asperellum as Biological Control Agent  
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Signature of Student :  .....

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## ABSTRACT

Malaysia has been on the list of the top 20 pineapple producing countries in the world. The success of MD2 variety in meeting the high demand in local and international markets has hastened the government to focus on fresh fruits production. However, postharvest losses of fresh fruits are common problems in developing countries, including Malaysia. One of several factors that contribute to the postharvest losses of fresh fruits is pathological disorders caused by pathogenic microorganisms. Black rot disease of pineapple is a postharvest disease caused by a facultative parasitic fungus known as *Ceratocystis paradoxa* (Dade) C. Moreau. This pathogen could tremendously shorten the shelf-life of MD2 pineapple during transportation and storage by making the flesh disintegrated, watery rot and eventually causing severe damage. To date, the role of chemical pesticides in controlling postharvest disease has been the subject of controversial debate. In this study, biological control agent plays a major role as a promising alternative method to control black rot disease of pineapple. A total of 17 isolates consisted of 13 different isolates of fungi, and four different isolates of bacteria were isolated from asymptomatic MD2 pineapple leaves and fruits. The antagonistic activities of 17 isolates against *C. paradoxa* were evaluated using a dual culture test. The most promising isolate with Percentage Inhibition of Radial Growth (PIRG) value of 97.5% was confirmed as *Trichoderma asperellum* (JX913783.1) using ITS rRNA gene. The assessment of disease severity index and disease progression analysis of MD2 pineapples were evaluated within ten days in the laboratory at room temperature, 25°C. After ten days, pineapples inoculated with *C. paradoxa* alone (positive control, T1) exhibited (100% severity index, 7.66 AUDPC units<sup>2</sup>, and 0% disease reduction), pineapples dipped in sterile distilled water (control, T2) exhibited (0% severity index, 0 AUDPC units<sup>2</sup>, and 100% disease reduction), pineapples dipped in 10<sup>9</sup> cfu/mL spore suspension of *T. asperellum* alone (negative control, T3) exhibited (0% severity index, 0 AUDPC units<sup>2</sup>, and 100% disease reduction), pineapples inoculated with *C. paradoxa*, followed by dipping in 10<sup>9</sup> cfu/mL spore suspension of *T. asperellum* after 4 hours (curative, T4) exhibited (100% severity index, 6.22 AUDPC units<sup>2</sup>, and 18.83% disease reduction) and pineapples dipped in 10<sup>9</sup> cfu/mL spore suspension of *T. asperellum*, followed by the inoculation of *C. paradoxa* after 4 hours (preventive, T5) exhibited (66.70% severity index, 4.56 AUDPC units<sup>2</sup>, and 40.57% disease reduction). The findings revealed the application of 10<sup>9</sup> cfu/mL spore suspension of *T. asperellum* 4 hours prior to pathogen inoculation (T5) was effective in preventing black rot disease in MD2 pineapples. This suggested the application of biological control agents prior to disease infection increases its effectiveness against postharvest pathogen(s).

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# TABLE OF CONTENTS

	<b>Page</b>
<b>CONFIRMATION BY PANEL OF EXAMINERS</b>	<b>ii</b>
<b>AUTHOR'S DECLARATION</b>	<b>iii</b>
<b>ABSTRACT</b>	<b>iv</b>
<b>ACKNOWLEDGEMENT</b>	<b>v</b>
<b>TABLE OF CONTENTS</b>	<b>vi</b>
<b>LIST OF TABLES</b>	<b>x</b>
<b>LIST OF FIGURES</b>	<b>xi</b>
<b>LIST OF PLATES</b>	<b>xii</b>
<b>LIST OF SYMBOLS</b>	<b>xv</b>
<b>LIST OF ABBREVIATIONS</b>	<b>xvii</b>
<b>CHAPTER ONE: INTRODUCTION</b>	<b>1</b>
1.1 Background of the Study	1
1.2 Problem Statement	6
1.3 Research Objectives	7
1.4 Research Questions and Hypotheses	7
1.5 Significance of the Study	8
1.6 Scope and Delimitation of the Study	8
<b>CHAPTER TWO: LITERATURE REVIEW</b>	<b>9</b>
2.1 Pineapple Black Rot Disease	9
2.2 <i>Ceratocystis paradoxa</i>	11
2.3 The History of Pineapple ( <i>Ananas comosus</i> L. Merr.)	14
2.4 The Importance and Benefits of Pineapple ( <i>Ananas comosus</i> L. Merr.)	16
2.5 The MD2 Pineapple	19
2.6 Postharvest Fruits Losses in Developing Countries	21
2.7 Pineapple Black Rot Controls	24
2.7.1 Hot Water Treatment	24
2.7.2 Generally Recognized as Safe (GRAS) Compounds	24