

**EFFICIENCY OF ENDOPHYTIC FUNGI ISOLATED FROM HEALTHY  
BRANCHES FOR MANAGEMENT OF VASCULAR STREAK DIEBACK ON  
COCOA**

**NORLILYANA BINTI ZAINON**

**Final Year Project Report Submitted in  
Partial Fulfilment of the Requirements for the  
Degree of Bachelor of Science (Hons.) Technology and Plantation Management  
in the Faculty of Plantation and Agrotechnology  
Universiti Teknologi MARA**

**JULY 2019**

## **ACKNOWLEDGEMENTS**

Alhamdulillah, I am very grateful to Almighty God, Allah Subhanahu wa ta'ala for giving me strength, inspiration, courageous and patience in completing the final year project and thesis writing. I would like to express my deepest gratitude to my supervisor, Dr. Hamzah Bin Abd Aziz for all the great knowledge that I have learned from him besides his continuous help and patience in all stages of preparing this report started from preparing proposal until finishing my thesis. I would also like to thank all the lecturers and staff of the Faculty of Plantation and Agrotechnology that give advices, encouragement, and guidance. Also, an appreciation to Miss Siti Nordinah Abd Aziz, the laboratory assistant at the mycology laboratory at UiTM (Melaka) Jasin Campus. It is a genuine pleasure to express my deep sense of thanks and gratitude to my parents and family for their continuous love and support either spiritual and financially. Last but not least, a special thanks to my partner Nur Hana Fariha Binti Che Zamri and to all my friends for always helping me not only in field and laboratory works but encouraged to complete my final year project. Thanks a lot to all that involve directly or indirectly that I could finish this final year project successfully.

NORLILYANA BINTI ZAINON

## TABLE OF CONTENTS

|  | <u>Page</u> |
|--|-------------|
| <b>ACKNOWLEDGEMENTS</b>  | i           |
| <b>TABLE OF CONTENTS</b>   | ii          |
| <b>LIST OF FIGURES</b>   | iv          |
| <b>LIST OF TABLES</b>  | v           |
| <b>LIST OF ABBREVIATIONS</b>   | vi          |
| <b>ABSTRACT</b>  | vii         |
| <b>ABSTRAK</b>   | viii        |
| <br>   |             |
| <b><u>CHAPTER</u></b>  |             |
| <b>1 INTRODUCTION</b>  |             |
| 1.1 Background of study  | 1           |
| 1.2 Problem statement  | 2           |
| 1.3 The specific objectives  | 3           |
| 1.4 Significance of study  | 3           |
| 1.5 Limitation of study  | 3           |
| <br>   |             |
| <b>2 LITERATURE REVIEW</b>   |             |
| 2.1 Cocoa  | 4           |
| 2.1.1 Scientific classification                                      | 4           |
| 2.1.2 Origin and cultivation   | 6           |
| 2.1.3 Morphology   | 7           |
| 2.1.4 Variety of Cocoa   | 13          |
| 2.2 Cocoa's pests  | 14          |
| 2.3 Disease of Cocoa   | 14          |
| 2.3.1 Vascular Streak Dieback (VSD)                                  | 15          |
| 2.3.2 <i>Ceratobasidium theobromae</i> as the causal pathogen of VSD | 16          |
| 2.3.3 Identification of <i>C. theobromae</i> species                 | 17          |
| 2.3.4 Morphological identification                                   | 17          |
| 2.4 Disease management   | 17          |
| 2.4.1 Chemical control   | 18          |
| 2.4.2 Biological control   | 18          |
| 2.5 Endophytic fungi as a biological control agent                   | 19          |
| 2.5.1 Endophytic fungi's colony                                      | 20          |
| 2.5.2 Mode entry of endophytic fungi                                 | 20          |
| 2.5.3 Ability of endophytic fungi as biological control agent        | 21          |
| <br>   |             |
| <b>3 RESEARCH METHODOLOGY</b>  |             |
| 3.1 Sampling of infected plants                                      | 22          |
| 3.2 Sampling of endophytic fungi                                     | 23          |
| 3.3 Isolation activities   | 24          |
| 3.3.1 Growth media preparation                                       | 24          |
| 3.3.2 Isolation of <i>Ceratobasidium</i> species                     | 24          |
| 3.3.3 Isolation technique of endophytic fungi                        | 25          |
| 3.3.4 Sub-culture  | 26          |
| 3.3.5 Dual culture technique   | 26          |

|          |   |           |
|----------|---|-----------|
| <b>4</b> | <b>RESULTS AND DISCUSSION</b>   |           |
| 4.1      | Isolation and morphological identification  | 28        |
| 4.1.1    | <i>Ceratobasidium theobromae</i>  | 28        |
| 4.1.2    | Endophytic fungi  | 31        |
| 4.2      | The antagonistic activity of unknown endophytic fungi to inhibit <i>C. theobromae</i> species | 33        |
| 4.2.1    | Negative control  | 33        |
| 4.2.2    | Dual culture  | 34        |
| 4.2.3    | Measuring inhibition percent  | 35        |
| <b>5</b> | <b>CONCLUSIONS AND RECOMMENDATIONS</b>  | <b>37</b> |
|          | <b>REFERENCES</b>   | <b>38</b> |
|          | <b>APPENDICES</b>   | <b>41</b> |
|          | <b>CURRICULUM VITAE</b>   | <b>42</b> |

## ABSTRACT

### EFFICIENCY OF ENDOPHYTIC FUNGI ISOLATED FROM HEALTHY BRANCHES FOR MANAGEMENT OF VASCULAR STREAK DIEBACK ON COCOA

Cocoa (*Theobromae cacao* L.) has been known as one of the most important industrial commodities in the worldwide. However, the cocoa industry in Malaysia is significantly reduced in terms of quantity and quality of production because facing the problem of attack by pests and pathogens. In Malaysia, Vascular Streak Dieback (VSD) is one of the most significant diseases. VSD disease is caused by a fungus, *Ceratobasidium theobromae*, which infects the cocoa leaf during the early formation period, and then develops into an infection in the xylem vessels. In this study, endophytic fungi were used as a biological control agent and alternative method instead using chemical control that will give negative impact to human and environment. The pathogen and endophytic fungi were isolated from branches of cocoa trees and grown on potato dextrose agar (PDA), water agar and coconut agar to measure growth responds. All isolates were identified by referring to previous study by some researchers of *C. Theobromae* and endophytic fungi. Based on the result of the isolation, there are 6 unknown endophytic species succesfully isolated, however only 2 species can inhibit the VSD. These unknown endophytic fungi were effective to inhibit mycelial growth of *C. theobromae* in vitro with 62.30% inhibition. This study believed that these endophytic fungi are able to prevent growth of *C. theobromae*.

Keyword: *Theobromae cacao* L., *Ceratobasidium theobromae*, vascular streak dieback (VSD), endophytic fungi, potato dextrose agar (PDA).