

LIST OF CONTENTS

	Page
COVER.....	i
COVER PAGE.....	ii
APPROVAL PAGE.....	iii
PLAGIARISM FREE STATEMENT.....	iv
ACKNOWLEDGMENT.....	v
LIST OF CONTENTS.....	vi
LIST OF TABLES.....	viii
LIST OF FIGURES.....	ix
LIST OF ATTACHMENT.....	x
ABSTRACT.....	xi
INTISARI.....	xii
I. INTRODUCTION.....	1
1.1. Background.....	1
1.2. Problems.....	4
1.3. Purposes.....	4
1.4. Benefit.....	4
II. LITERATURE REVIEW.....	5
2.1. Distribution history of <i>Fusarium</i> wilt.....	5
2.2. Symptoms of <i>Fusarium</i> wilt.....	6
2.3. Taxonomy of <i>Fusarium</i> wilt as causal agent.....	8
2.4. Morphological of <i>Fusarium oxysporum</i> f.sp <i>cubense</i>	9
2.5. Life cycle of <i>Foc</i>	10
2.6. Variabilty of <i>Foc</i>	12
2.7. <i>Secreted In Xylem (SIX)</i>	14
2.8. Plant Defense.....	19
2.9. Hypothesis.....	20
III. MATERIAL AND METHOD.....	21
3.1. Virulence assays <i>Foc</i> in banana.....	22
3.1.1. Preparation of inoculum.....	22

3.1.2. Inoculation <i>Foc</i> to banana.....	22
3.1.3. Observation of external symptoms.....	23
3.1.4. Observation of internal symptoms.....	23
3.1.5. Calculating Disease Severity Index (DSI).....	23
3.1.6. Calculating of disease incidency and diseases severity.....	24
3.2. Molacular anakysis of virulence and defense genes.....	25
3.2.1. DNA isolation of <i>Foc</i>	25
3.2.2. DNA amplification.....	26
3.2.3. Preparation banana's plantlets and inoculum.....	26
3.2.4. Inoculation selected <i>Foc</i> isolates to banana.....	27
3.2.5. RNA extraction.....	27
3.2.6. Quantification of RNA.....	28
3.2.7. cDNA synthesis.....	28
3.2.8. DNA amplification and electrophoresis.....	29
3.2.9. Real-time Polymerase Chain Reaction (qPCR).....	30
3.2.10. Data Analysis.....	30
IV.RESULT AND DISCUSSION.....	32
4.1. Virulence level test on seedling of banana cv. Cavendish.....	32
4.2. The expression of virulence-related genes using qPCR analysis.....	36
4.3. The expression of of plant defense genes using qPCR analysis.....	40
V. CONCLUSION.....	44
5.1. Conclusion.....	44
5.2. Suggestion.....	44
BIBLIOGRAPHY.....	45
ATTACHMENT.....	53

LIST OF TABLES

	Page
Table 1. Pathogenic races of <i>Foc</i>	13
Table 2. The SIX genes repertoire of <i>Foc</i>	15
Table 3. <i>Foc</i> samples used in this research	22
Table 4. Leaf Symptoms Index (LSI).....	23
Table 5. Rhizome Discolorization Index (RDI).....	23
Table 6. Remarks on DSI Scale.....	24
Table 7. Scoring grade of yellowing leaves for observation of diseases intensity..	24
Table 8. Reaction Solution for cDNA synthesis.....	29
Table 9. List of primers used in this research.....	30
Table 10. Virulence test of isolates of <i>Foc</i> in banana cv. Cavendish.....	32

LIST OF FIGURES

	Page
Figure 1. The symptoms of <i>Fusarium</i> wilt.....	7
Figure 2. Internal symptoms of <i>Fusarium</i> wilt.....	8
Figure 3. Microscopic structure of <i>Foc</i>	10
Figure 4. Life Cycle of <i>Foc</i>	12
Figure 5. Diseases severity, incidence of <i>Fusarium</i> wilt in banana cv. Cavendish.	34
Figure 6. Banana cv. Cavendish after inoculation with isolate Batu4 and KJG of <i>Fusarium oxysporum f. sp. Cubense</i> (<i>Foc</i>).....	35
Figure 7. Visualisation of PCR using <i>FocEf3</i> primer.....	36
Figure 8. Relative expression of <i>SIX1b</i> gene of <i>Foc</i> for 4 dpi.....	38
Figure 9. Relative expression of <i>SIX1c</i> gene of <i>Foc</i> for 4 dpi.....	38
Figure 10. Heatmap comparison of expressed <i>secreted in xylem</i> genes.....	39
Figure 11. Relative expression of <i>pr-protein1</i> gene in <i>Musa acuminata</i> cv. Cavendish and Barangan.....	41
Figure 12. Relative expression of <i>chitinase</i> gene in <i>Musa acuminata</i> cv. Cavendish and Barangan.....	41
Figure 13. Heatmap comparison of expressed <i>pathogen related protein 1</i> (PR protein 1) and <i>chitinase</i> genes.....	42

LIST OF ATTACHMENTS

	Page
Attachment 1. Banana cv. Cavendish after inoculation with isolates of <i>Fusarium oxysporum f. sp. cubense</i> (Foc).....	53
Attachment 2. The analysis of relative gene expression data was conducted using the $2^{-\Delta\Delta C_T}$ method.....	57
Attachment 3. Reconfirmation of <i>SIX</i> genes and plant defense genes.....	62