

LIST OF CONTENTS

| | Page |
|---|------|
| Acknowledgements | iii |
| Abstract (in English) | iv |
| (in Thai) | v |
| List of contents | vi |
| List of tables | ix |
| List of figures | x |
| Abbreviations and symbols | xiv |
| Chapter 1 Introduction | 1 |
| Chapter 2 Literature review | 3 |
| 2.1 The <i>Allium</i> plants | 3 |
| 2.2 The cultivation of shallot and onion | 6 |
| 2.3 Problems of crop production | 6 |
| 2.4 Bulb crop storage | 6 |
| 2.5 Problems of bulb crop storage | 7 |
| 2.6 Management of postharvest loss | 7 |
| 2.7 Synthetic chemicals in management of postharvest diseases | 8 |
| 2.8 Biocontrol agents from plants | 9 |
| 2.8.1 Garlic | 10 |
| 2.8.2 Galangal | 11 |
| 2.8.3 Ginger | 12 |
| 2.8.4 Lemon grass | 13 |
| 2.8.5 Shallot | 13 |
| 2.8.6 Onion | 14 |

LIST OF CONTENTS (CONTINUED)

| | Page |
|---|-------------|
| 2.8.7 Others plant | 14 |
| 2.9 Concluding remarks | 26 |
| Chapter 3 Materials and method | 27 |
| 3.1 Materials | 27 |
| 3.1.1 Plants | 27 |
| 3.1.2 Culture medium | 27 |
| 3.1.3 Media and chemical reagents | 27 |
| 3.1.4 Equipments | 28 |
| 3.2 Methods | 28 |
| 3.2.1 Screening of pathogenic fungi from shallot and onion | 28 |
| 3.2.2 Preparation of spore suspension | 29 |
| 3.2.3 Preparation of plant extracts | 29 |
| 3.2.3.1 Aqueous fresh plant extraction | 29 |
| 3.2.3.2 Ethanolic dry plant extraction | 30 |
| 3.2.3.3 Methanolic dry plant extraction | 30 |
| 3.2.4 Antifungal activity test | 30 |
| 3.2.5 Study of plant extract concentration and antifungal activity | 31 |
| 3.2.6 Effect of plant extracts on fungal inoculated shallot and onion | 31 |
| 3.2.7 Statistical analysis | 32 |
| Chapter 4 Results and discussion | 33 |
| 4.1 Screening of pathogenic fungi from shallot and onion | 33 |
| 4.2 Antifungal activity test | 35 |
| 4.2.1 Effect of aqueous fresh plant extracts on fungal growth | 35 |
| 4.2.2 Effect of ethanolic dry plant extracts on fungal growth | 43 |
| 4.2.3 Effect of methanolic dry plant extracts on fungal growth | 51 |
| 4.2.4 Stability of plant extracts | 60 |

LIST OF CONTENTS (CONTINUED)

| | Page |
|--|-------------|
| 4.2.5 Study of plant extract concentration and antifungal activity | 60 |
| 4.2.6 Effect of plant extracts on fungal inoculated shallot | 67 |
| 4.2.7 Effect of plant extracts on fungal inoculated onion | 71 |
| Chapter 5 Conclusions | 72 |
| References | 73 |
| Appendix A: Data of percentage inhibition | 84 |
| Appendix B: Data of weight loss | 85 |
| Curriculum Vitae | 86 |

LIST OF TABLES

| Table | Page |
|---|-------------|
| Table 2.1 Nutritional information for shallot and onion from 100 grams | 5 |
| Table 2.2 Quantity and value of shallot and onion exports, 2001-2005 | 5 |
| Table 2.3 Shallot: Area and production by whole kingdom | 6 |
| Table 2.4 Onion: Area and production by whole kingdom | 6 |
| Table 2.5 Antimicrobial ability of extracted plant by the distilled water | 16 |
| Table 2.6 Antimicrobial ability of extracted plant by ethanol | 18 |
| Table 2.7 Antimicrobial ability of extracted plant by methanol | 20 |
| Table 2.8 Antimicrobial ability of extracted plant by acetone | 22 |
| Table 2.9 Antimicrobial ability of extracted plant by phenol | 22 |
| Table 2.10 Antimicrobial ability of extracted plant by petroleum ether | 23 |
| Table 2.11 Antimicrobial ability of extracted plant by dichloromethane | 23 |
| Table 2.12 Antimicrobial ability of extracted plant by chloroform | 24 |
| Table 2.13 Antimicrobial ability of extracted plant hexane | 24 |
| Table 2.14 Antimicrobial ability of extracted plant by ethyl acetate | 25 |
| Table 4.1 The characterization of six isolates | 33 |
| Table 4.2 The species of fungi from the isolation | 34 |
| Table 4.3 Effect of plant extracts on shallot bulbs (no inoculation) | 67 |
| Table 4.4 Effect of plant extracts on shallot bulbs inoculated with <i>A. niger</i> 2 | 68 |
| Table 4.5 Effect of plant extracts on shallot bulbs inoculated with <i>Penicillium</i> sp.3 | 69 |
| Table 4.6 Effect of plant extracts on shallot bulbs inoculated with <i>Penicillium</i> sp.4 | 70 |

LIST OF FIGURES

| Figure | Page |
|--|------|
| Fig. 2.1 Examples of <i>Allium</i> plants | 4 |
| Fig. 2.2 Traditional method for drying of shallot (A) and product in the market (B) | 7 |
| Fig. 4.1 Colony morphology of six isolates on PDA plates | 34 |
| Fig. 4.2 Characteristic of <i>Aspergillus niger</i> (A) and <i>Penicillium</i> sp. (B) under microscope, × 400 | 35 |
| Fig. 4.3 Effect of each aqueous fresh plant extract on the growth of <i>Penicillium</i> sp.1 after 5 days of incubation. | 36 |
| Fig. 4.4 The effect of six aqueous fresh plant extracts on growth inhibition of <i>A. niger</i> 1 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 37 |
| Fig. 4.5 The effect of six aqueous fresh plant extracts on growth inhibition of <i>A. niger</i> 2 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 38 |
| Fig. 4.6 The effect of six aqueous fresh plant extracts on growth inhibition of <i>Penicillium</i> sp.1 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 39 |
| Fig. 4.7 The effect of six aqueous fresh plant extracts on growth inhibition of <i>Penicillium</i> sp.2 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 40 |
| Fig. 4.8 The effect of six aqueous fresh plant extracts on growth inhibition of <i>Penicillium</i> sp.3 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 41 |
| Fig. 4.9 The effect of six aqueous fresh plant extracts on growth inhibition of <i>Penicillium</i> sp.4 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 42 |

LIST OF FIGURES (CONTINUED)

| Figure | Page |
|---|------|
| Fig. 4.10 Effect of ethanolic dry plant extracts on the growth of <i>Penicillium</i> sp.1 after 5 days of incubation | 44 |
| Fig. 4.11 The effect of six ethanolic dry plant extracts on growth inhibition of <i>A. niger</i> 1 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 45 |
| Fig. 4.12 The effect of six ethanolic dry plant extracts on growth inhibition of <i>A. niger</i> 2 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 46 |
| Fig. 4.13 The effect of six ethanolic dry plant extracts on growth inhibition of <i>Penicillium</i> sp.1 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 47 |
| Fig. 4.14 The effect of six ethanolic dry plant extracts on growth inhibition of <i>Penicillium</i> sp.2 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 48 |
| Fig. 4.15 The effect of six ethanolic dry plant extracts on growth inhibition of <i>Penicillium</i> sp.3 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 49 |
| Fig. 4.16 The effect of six ethanolic dry plant extracts on growth inhibition of <i>Penicillium</i> sp.4 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 50 |
| Fig. 4.17 Effect of methanolic dry plant extracts on the growth of <i>Penicillium</i> sp.1 after 3 days of incubation | 52 |
| Fig. 4.18 The effect of six methanolic dry plant extracts on growth inhibition Of <i>A. niger</i> 1 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 53 |

LIST OF FIGURES (CONTINUED)

| Figure | Page |
|--|------|
| Fig. 4.19 The effect of six methanolic dry plant extracts on growth inhibition of <i>A. niger</i> 2 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 54 |
| Fig. 4.20 The effect of six methanolic dry plant extracts on growth inhibition of <i>Penicillium</i> sp.1 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 55 |
| Fig. 4.21 The effect of six methanolic dry plant extracts on growth inhibition of <i>Penicillium</i> sp.2 (evaluated in term of inhibition zone diameter) in range of 1 to 5 days | 56 |
| Fig. 4.22 The effect of six methanolic dry plant extracts on growth inhibition of <i>Penicillium</i> sp.3 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 57 |
| Fig. 4.23 The effect of six methanolic dry plant extracts on growth inhibition of <i>Penicillium</i> sp.4 (evaluated in term of inhibition zone diameter) in a range of 1 to 5 days | 58 |
| Fig. 4.24 Effect of plant extracts on fungal growth for a month | 60 |
| Fig. 4.25 The effect of four plant extracts on growth inhibition of <i>A. niger</i> 1 (evaluated in term of inhibition zone diameter) in DAY 1 (A) and DAY 5 (B) | 61 |
| Fig. 4.26 The effect of four plant extracts on growth inhibition of <i>A. niger</i> 2 (evaluated in term of inhibition zone diameter) in DAY 1 (A) and DAY 5 (B) | 62 |
| Fig. 4.27 The effect of four plant extracts on growth inhibition of <i>Penicillium</i> sp.1 (evaluated in term of inhibition zone diameter) in DAY 1 (A) and DAY 5 (B) | 63 |

LIST OF FIGURES (CONTINUED)

| Figure | Page |
|---|------|
| Fig. 4.28 The effect of four plant extracts on growth inhibition of <i>Penicillium</i> sp.2 (evaluated in term of inhibition zone diameter) in DAY 1 (A) and DAY 5 (B) | 64 |
| Fig. 4.29 The effect of four plant extracts on growth inhibition of <i>Penicillium</i> sp.3 (evaluated in term of inhibition zone diameter) in DAY 1 (A) and DAY 5 (B) | 65 |
| Fig. 4.30 The effect of four plant extracts on growth inhibition of <i>Penicillium</i> sp.4 (evaluated in term of inhibition zone diameter) in DAY 1 (A) and DAY 5 (B) | 66 |