

TABLE OF CONTENTS

TITLE PAGE.....	i
APPROVAL OF THESIS	ii
STATEMENT	iii
ACKNOWLEDGEMENTS	iv
TABLE OF CONTENTS	v
LIST OF TABLES	vii
LIST OF FIGURES	viii
LIST OF APPENDICES	ix
LIST OF ABBREVIATIONS	x
ABSTRACT	xii
INTISARI.....	xiii
 CHAPTER 1. INTRODUCTION.....	 1
1.1 Background.....	1
1.2 Objectives.....	3
1.3 Research Benefits.....	4
 CHAPTER 2. LITERATURE REVIEW	 5
2.1 The Importance of Shallot	5
2.2 Viruses Infecting <i>Allium</i> Plants All Over the World	7
2.3 Viruses of <i>Allium</i> plants in three main genera.....	11
2.3.1 <i>Allexivirus</i>	11
2.3.2 <i>Carlavirus</i>	14
2.3.3 <i>Potyvirus</i>	16
2.4 Virus Transmission	20
2.5 Methods for Virus Detection and Identification	23
2.6 Hypotheses	28
 CHAPTER 3. MATERIALS AND METHODS	 29
3.1 Surveys and Sample Collection	29
3.2 Virus RNA Extraction.....	31
3.3 Synthesis of cDNA	33
3.4 DNA Amplification.....	33
3.5 Agarose Gel Electrophoresis	34
3.6 Dot Blot Hybridization.....	35
3.7 Nucleotide Sequencing and Sequence Analysis	38
3.8 Data Analysis.....	39
 CHAPTER 4. RESULTS AND DISCUSSION	 40
4.1 Field Survey.....	40
4.2 Virus Detection.....	43
4.2.1 Virus Infection Level	47
4.2.2 Virus Infection Pattern	54

4.3 Virus Identification	56
4.3.1 Dot Blot Hybridization.....	56
4.3.2 Nucleotide Sequencing.....	61
CHAPTER 5. CONCLUSIONS AND RECOMMENDATIONS.....	67
5.1 Conclusions	67
5.2 Recommendations.....	67
SUMMARY	69
RINGKASAN.....	83
REFERENCES	98
APPENDICES	108