

## TABLE OF CONTENTS

1. INTRODUCTION .....	1
2. REVIEW OF LITERATURE.....	8
2.1 Taxonomic Treatments .....	8
2.2 Phenological Analyses .....	12
2.2.1 Germination and Growth.....	12
2.3 Morphological Analyses .....	13
2.3.1 Floral Biology.....	13
2.3.2 Fruit and Seed.....	13
2.4 Cytological Studies.....	14
2.5 Genetical Studies .....	15
2.6 Biochemical Studies .....	15
2.7 Medicinal Properties .....	16
2.7.1 Traditional, Herbal, Ethnomedicinal and Folklore Properties.....	16
2.7.2 Modern Medicinal Properties.....	18
2.7.3 Other Important Uses of <i>S. obtusifolia</i> .....	19
2.8 Review of Literature on Active Compounds.....	19
2.8.1 Anthraquinones.....	20
2.8.2 Rhein .....	21
2.8.2.1 Hepatoprotective Activity of Rhein.....	22
2.8.2.2 Antioxidant Activity of Rhein .....	22
2.8.2.3 Anti-Inflammatory Activity of Rhein .....	22
2.8.2.4 Antidiabetic Activity of Rhein.....	23

2.8.2.5 Nephroprotective Activity of Rhein.....	23
2.8.2.6 Chondroprotective Activity of Rhein.....	24
2.8.2.7 Anticancer Activity of Rhein.....	24
2.8.2.8 Antimicrobial Activity of Rhein.....	25
2.8.2.9 Purgative Activity of Rhein.....	25
2.8.2.10 Lipid-Lowering Activity of Rhein.....	26
2.8.2.11 Other Activities of Rhein.....	26
3. PHENOLOGICAL VARIATIONS OF <i>S. obtusifolia</i> PROVENANCES.....	27
3.1 ACCESSIONS.....	28
3.2 MATERIALS AND METHODS .....	30
3.2.1 Collection of Germplasm .....	30
3.2.2 Seed Germination .....	30
3.2.3 Raising of Plants .....	30
3.3 RESULTS AND DISCUSSIONS .....	37
3.3.1 Growth Patterns .....	37
3.3.2 Flowering Curves.....	40
3.3.3 Fruiting Performance .....	43
3.3.4 Major Findings .....	46
3.3.5 Discussions.....	49
4. MORPHOLOGICAL VARIATIONS OF <i>S. obtusifolia</i> PROVENANCES.....	51
4.1 MATERIALS AND METHODS .....	52
4.1.1 Morphometric Analysis.....	52

4.2 RESULTS AND DISCUSSIONS .....	61
4.2.1 Discussions .....	85
5. CYTOLOGICAL VARIATIONS OF <i>S. obtusifolia</i> PROVENANCES .....	89
5.1 MATERIALS AND METHODS .....	90
5.1.1 Materials.....	90
5.1.1.1 Collection of Seed.....	90
5.1.2 Methods.....	91
5.1.2.1 Germination of Seed .....	91
5.1.2.2 Treatment of Excised Root or Tissue.....	91
5.1.2.3 Fixation of Tissue .....	91
5.1.2.4 Staining with Orcein .....	92
5.1.2.5 Squashing .....	92
5.1.2.6 Observation and Photography of Chromosome.....	92
5.1.2.7 Karyotype and Ideogram Generation.....	92
5.1.2.8 Karyotype Asymmetry Analysis.....	93
5.1.2.9 Asymmetry Analysis.....	94
5.2 RESULTS AND DISCUSSIONS .....	94
6. ANALYSIS OF RHEIN .....	121
6.1 MATERIALS AND METHODS .....	130
6.1.1 Materials.....	130
6.1.2 Methods.....	130
6.1.2.1 Preparation of Sample .....	130

6.1.2.2 Extraction of Rhein .....	130
6.1.2.3 TLC Procedures .....	131
6.1.2.4 HPLC Procedures.....	132
6.1.2.4.1 Chromatographic Conditions and Instrumentation.....	132
6.1.2.4.2 Preparation of Standards.....	132
6.1.2.4.3 Preparation of Sample Solutions.....	133
6.1.2.4.4 ESI MS .....	133
6.2 RESULTS AND DISCUSSION.....	134
6.2.1 TLC Analysis.....	134
6.2.2 HPLC Analysis .....	134
6.2.2.1 Chromatogram of Standard Rhein .....	134
6.2.2.2 Calibration Curve.....	134
6.2.2.3 Identification and Quantification of Rhein.....	139
6.2.2.4 Confirmation of Rhein in ESI MS spectrum .....	155
6.2.3 Discussions.....	158
7. AFLP ANALYSIS OF <i>S. obtusifolia</i> PROVENANCES.....	160
7.1 MATERIALS AND METHODS .....	162
7.1.1 Materials.....	162
7.1.2 Methods.....	162
7.1.2.1 DNA Extraction .....	162
7.1.2.2 AFLP Assay.....	163
7.1.2.3 Restriction Digestion of Genomic DNA .....	163

7.1.2.4 Adapter Ligation .....	164
7.1.2.5 Pre-amplification.....	164
7.1.2.6 Primer Sequences.....	165
7.1.2.7 Primer Labeling .....	165
7.1.2.8 Selective Amplification.....	166
7.1.2.9 Jaccard's Coefficient of Genetic Similarity .....	166
7.1.2.10 Hierarchical Clustering Using UPGMA.....	167
7.2 RESULTS AND DISCUSSIONS .....	167
7.2.1 Results .....	167
7.2.2 Discussions .....	183
8. DISCUSSION .....	185
9. CONCLUSIONS .....	201
10. SUMMARY .....	203
11. BIBLIOGRAPHY .....	205