

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	iii
ACRONYMS AND ABBREVIATIONS	v
TABLE OF CONTENTS	vi
LIST OF TABLES.....	ix
LIST OF FIGURES.....	x
ABSTRACT	xii
1 INTRODUCTION.....	1
2 LITERATURE REVIEW.....	4
2.1 Biodiversity in Sri Lanka.....	4
2.2 Domestication	5
2.2.1 Domestication process.....	5
2.2.2 Plant domestication	5
2.3 Importance of crop wild relative species for crop improvement.....	6
2.4 Historical background of Ceylon Cinnamon	7
2.5 Genus <i>Cinnamomum</i>	8
2.5.1 <i>Cinnamomum verum</i> (true cinnamon-cultivated cinnamon).....	9
2.5.2 <i>Cinnamomum dubium</i> (Sevel Kurundu).....	10
2.5.3 <i>Cinnamomum ovalifolium</i> (Bola Kurundu).....	11
2.5.4 <i>Cinnamomum capparucoronae</i> (Kappuru Kurundu).....	11
2.5.5 <i>Cinnamomum litseaefolium</i> (Kudu-Kurundu).....	11
2.5.6 <i>Cinnamomum rivulorum</i> (Wal Kurundu).....	12
2.5.7 <i>Cinnamomum sinharajaense</i> (Sinharaja Kurundu).....	12
2.5.8 <i>Cinnamomum citriodorum</i> (Pangiri Kurundu).....	12
2.6 Ecogeographical survey.....	12
2.7 Identification of threatened status by red listing.....	14
2.7.1 IUCN Global Red list categories and criteria.....	14
2.7.2 IUCN National Red list categories and criteria.....	18
2.8 Methods of chemical analysis of cinnamon leaf and bark.....	19
2.8.1 Principles of essential oil extraction.....	19
2.8.2 Principle of distillation	19
2.8.3 Modified Clevenger's method.....	19
2.8.4 Gas liquid chromatography (GLC).....	20
2.9 Conservation status of endemic wild <i>Cinnamomum</i> species in Sri Lanka	20

2.9.1	<i>Ex situ</i> conservation.....	20
2.9.2	<i>In situ</i> conservation.....	21
3	MATERIALS AND METHODS.....	22
3.1	Literature survey and observation of herbarium records to collect secondary data	22
3.2	Develop a species identification key	22
3.3	Development of potential distribution maps using available data & DIVA-GIS .	24
3.4	Field survey to explore and collect germplasm as primary data.....	24
3.5	Identification of threatened status based on IUCN global and national red list criteria.....	26
3.5.1	IUCN Global red list criteria	26
3.5.2	IUCN National red list criteria	28
3.6	Extinction risks assessment of endemic wild <i>Cinnamomum</i> species	32
3.7	Potential of domestication	32
3.7.1	Vegetative propagation and nursery practices.....	32
3.7.2	Chemical constituents of leaf and bark oil	32
3.7.3	Identification of priority species for domestication.....	33
3.8	Conservation activities.....	33
4	RESULTS AND DISCUSSION.....	35
4.1	Morphological, physicochemical and diagnostic characters of wild <i>Cinnamomum</i> species in Sri Lanka.....	35
4.1.1	<i>Cinnamomum dubium</i> Nees.....	35
4.1.2	<i>Cinnamomum ovalifolium</i> Weight.....	37
4.1.3	<i>Cinnamomum capparucoronde</i> Blume	39
4.1.4	<i>Cinnamomum litseaefolium</i> Thw.....	43
4.1.5	<i>Cinnamomum rivulorum</i> Kosterm.....	45
4.1.6	<i>Cinnamomum sinharajaense</i> Kosterm	47
4.1.7	<i>Cinnamomum citriodorum</i> Thw.	49
4.1.8	Statistical analysis of leaf morphological parameters	51
4.2	A modified key to identify wild <i>Cinnamomum</i> species in Sri Lanka.....	53
4.3	Distribution of endemic wild <i>Cinnamomum</i> species	55
4.3.1	Distribution of <i>Cinnamomum dubium</i> Nees	56
4.3.2	Distribution <i>Cinnamomum ovalifolium</i> Weight	57
4.3.3	Distribution of <i>Cinnamomum capparucoronde</i> Blume.....	58
4.3.4	Distribution of <i>Cinnamomum litseaefolium</i> Thw.	59

4.3.5	Distribution of <i>Cinnamomum rivulorum</i> Kostermn	60
4.3.6	Distribution of <i>Cinnamomum sinharajaense</i> Kosterm.....	61
4.3.7	<i>Cinnamomum citriodorum</i> Thw.	62
4.3.8	Potential distribution of endemic wild <i>Cinnamomum</i> species	63
4.4	Threatened status of wild <i>Cinnamomum</i> species.....	66
4.4.1	Global red listing analysis	66
4.4.2	National red listing analysis	76
4.4.3	Extinction risks assessment	77
4.5	Domestication of endemic wild <i>Cinnamomum</i> species in Sri Lanka	78
4.5.1	Chemical constitutes.....	78
4.5.2	Propagation.....	80
4.5.3	Useful characters	80
4.5.4	Difficult characters	81
4.6	Conservation activities of endemic wild <i>Cinnamomum</i> species.....	81
4.6.1	<i>In-situ</i> conservation	81
4.6.2	<i>Ex-situ</i> conservation	84
5	CONCLUSIONS.....	85
6	REFERANCES	87
ANNEX 01:	94
ANNEX 02:	96
ANNEX 03:	99
ANNEX 04:	101
ANNEX 05:	102

LIST OF TABLES

Table 1: Chemical constituents of <i>Cinnamomum verum</i> leaf, bark and root oil	9
Table 2: Details of national herbarium deposited wild <i>Cinnamomum</i> specimens	25
Table 3: Location of germplasm exploration	26
Table 4: IUCN Red List Criterion B	27
Table 5: Criteria and Scoring System.....	28
Table 6: Cut off point of national red listing criteria average values	32
Table 7: Variations of mean values in some leaf morphological parameters.....	51
Table 8: National red listing scoring values of endemic <i>Cinnamomum</i> species	76
Table 9: Average red listing scoring value	77
Table 10: Calculated extinction risks values of endemic wild <i>Cinnamomum</i> species	77
Table 11: Chemical constituents of <i>Cinnamomum citriodorum</i> bark and leaf oil	78
Table 12: Chemical constituents of <i>Cinnamomum capparucoronae</i> bark and leaf oil.....	79
Table 13: Chemical constituents of <i>Cinnamomum dubium</i> bark and leaf oil.....	79

LIST OF FIGURES

Figure 1: Structure of the IUCN Red List categories	15
Figure 2: Different morphological characters of <i>Cinnamomum dubium</i>	35
Figure 3: Diagnostic characters of <i>Cinnamomum dubium</i>	36
Figure 4: Line diagram of <i>Cinnamomum dubium</i>	36
Figure 5: Different morphological characters of <i>Cinnamomum ovalifolium</i>	37
Figure 6: Diagnostic characters of <i>Cinnamomum ovalifolium</i>	38
Figure 7: Line diagram of <i>Cinnamomum ovalifolium</i>	38
Figure 8: Different morphological characters of <i>Cinnamomum capparucoronae</i>	39
Figure 9: Diagnostic characters of <i>Cinnamomum capparucoronae</i>	40
Figure 10: Line diagram of <i>Cinnamomum capparucoronae</i> (with flower buds).....	41
Figure 11: Line diagram of <i>Cinnamomum capparucoronae</i> (leaf arrangement).....	42
Figure 12: Different morphological characters of <i>Cinnamomum litseaefolium</i>	43
Figure 13: Diagnostic characters of <i>Cinnamomum litseaefolium</i>	44
Figure 14: Line diagram of <i>Cinnamomum litseaefolium</i>	44
Figure 15: Morphological and diagnostic characters of <i>Cinnamomum rivulorum</i>	45
Figure 16: Line diagram of <i>Cinnamomum rivulorum</i>	46
Figure 17: Morphological and diagnostic characters of <i>Cinnamomum sinharajaense</i>	47
Figure 18: Line diagram of <i>Cinnamomum sinharajaense</i>	48
Figure 19: Morphological and diagnostic characters of <i>Cinnamomum citriodorum</i>	49
Figure 20: Line diagram of <i>Cinnamomum citriodorum</i>	50
Figure 21: Cluster diagram of wild <i>Cinnamomum</i> species	52
Figure 22: Distribution map of endemic wild <i>Cinnamomum</i> species in Sri Lanka.....	55
Figure 23: Current distribution of <i>Cinnamomum dubium</i>	56
Figure 24: Current distribution of <i>Cinnamomum ovalifolium</i>	57
Figure 25: Current distribution of <i>Cinnamomum capparucoronae</i>	58
Figure 26: Current distribution of <i>Cinnamomum litseaefolium</i>	59
Figure 27: Current distribution of <i>Cinnamomum rivulorum</i>	60
Figure 28: Current distribution of <i>Cinnamomum sinharajaense</i>	61
Figure 29: Distribution map of <i>Cinnamomum citriodorum</i>	62
Figure 30: Potential distribution map of <i>Cinnamomum dubium</i>	63
Figure 31: Potential distribution map of <i>Cinnamomum ovalifolium</i>	63
Figure 32: Potential distribution map of <i>Cinnamomum capparucoronae</i>	64
Figure 33: Potential distribution map of <i>Cinnamomum litseaefolium</i>	64

Figure 34: Potential distribution map of <i>Cinnamomum rivulorum</i>	65
Figure 35: Potential distribution map of <i>Cinnamomum sinharajaense</i>	65
Figure 36: Potential distribution map of <i>Cinnamomum citriodorum</i>	66
Figure 37: Extent of occurrence map of <i>Cinnamomum dubium</i>	67
Figure 38: Variation of EOO and AOO values of <i>Cinnamomum dubium</i>	67
Figure 39: Extent of occurrence map of <i>Cinnamomum ovalifolium</i>	68
Figure 40: Extreme fluctuation of EOO and AOO values of <i>Cinnamomum ovalifolium</i> ...	69
Figure 41: Extent of occurrence map of <i>Cinnamomum capparu-coronde</i>	70
Figure 42: Variation of EOO and AOO values of <i>Cinnamomum capparu-coronde</i>	70
Figure 43: Extent of occurrence map of <i>Cinnamomum litseaefolium</i>	71
Figure 44: Variation of EOO and AOO values of <i>Cinnamomum litseaefolium</i>	71
Figure 45: Extent of occurrence map of <i>Cinnamomum rivulorum</i>	72
Figure 46: Continuing decline of EOO and AOO values of <i>Cinnamomum rivulorum</i>	73
Figure 47: Extent of occurrence map of <i>Cinnamomum sinharajaense</i>	74
Figure 48: Continuing decline of EOO and AOO values of <i>Cinnamomum sinharajaense</i> ..	74
Figure 49: Extent of occurrence map of <i>Cinnamomum citriodorum</i>	75
Figure 50: Continuing decline of EOO and AOO values of <i>Cinnamomum citriodorum</i>	76
Figure 51: Kapparu Kurundu plants with contour line map in 100 m x 80 m macro plot ..	82
Figure 52: Kapparu Kurundu plants with contour line map in 270 m x 50 m macro plot ..	83