

**Studies on diversity and distribution of corticolous lichens as**

**indicators of sulphur dioxide and nitrogen dioxide levels in**

**Colombo and suburbs**

**By**

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**Thesis submitted to the University of Sri Jayewardenepura for  
the award of the Degree of Master of Philosophy in Botany on**

**27<sup>th</sup> September 2006.**

“The work described in this thesis was carried out by me under the supervision of Prof. S.C. Wijeyaratne and a report on this has not been submitted in whole or in part to any university or any other institution for another Degree /Diploma”.

  
.....

A. M. N. P. Attanayake

“I/We certify that the above statement made by the candidate is true and that this thesis is suitable for submission to the university for the purpose of evaluation”.

...*S. C. Wijeyarathne*.....

Prof. S. C. Wijeyarathne



## CONTENTS

List of Tables	vi
List of figures	vii
List of plates	viii
<b>ACKNOWLEDGEMENTS</b>	ix
<b>ABSTRACT</b>	xi
<b>1. INTRODUCTION</b>	<b>1</b>
<b>2. LITERATURE REVIEW</b>	
2.1 Lichens and air pollution	6
2.1.1 General	6
2.1.2 Historical	8
2.1.3 Effect of environment on lichens	12
2.1.3.1 Shelter	12
2.1.3.2 pH of the substrate	13
2.1.3.3 Nutrients	14
2.1.3.4 Water relations	15
2.1.3.5 Age of substratum	16
2.1.4 General features of lichen deterioration	17
2.1.5 Causes of lichen deterioration	18
2.1.5.1 Background	18

2.1.5.2 Effect of SO <sub>2</sub> on lichen growth	19
2.1.5.3 Effect of SO <sub>2</sub> on physiology and biochemistry of lichens	20
2.1.5.4 Effect of nitrogen compounds on lichens	21
2.1.5.5 Resistance of lichens to pollution	23
2.1.6 Biological estimation of air pollution	24
2.2 Monitoring lichens	26
2.2.1 Monitoring lichens as indicators of pollution	26
2.2.2 Methods of monitoring lichens	31
2.2.2.1 Mapping	32
2.2.2.2 Index of atmospheric purity	34
2.2.2.3 Physiological methods	36
2.2.2.4 Response methods	36
2.2.2.5 Element bioaccumulation	37
2.2.2.6 Transplants	37
2.2.3 Some sampling method used in lichen monitoring	38
2.2.3.1 Lichen cover	38
2.2.3.2 Lichen frequency	39
2.2.3.3 Lichen diversity	40
2.3 Sulphur dioxide in the environment	40
2.4 Passive gas samplers	42
2.4.1 Introduction	42
2.4.2 Collection of gases	42
2.4.3 Draft shield/wind shield	43
2.4.4 Advantages of passive gas samplers	44

2.5	Air pollution monitoring in Sri Lanka	44
2.5.1	Air pollution studies with respect to SO <sub>2</sub> and NO <sub>2</sub> conducted in Colombo area	46
2.5.2	Air pollution studies with respect to SO <sub>2</sub> and NO <sub>2</sub> air pollution in industrial areas in Sri Lanka	48
2.5.3	Air pollution studies with respect to SO <sub>2</sub> and NO <sub>2</sub> air pollution in other areas in Sri Lanka	48
<b>3.</b>	<b>METHODOLOGY</b>	
3.1	Selection of study sites	51
3.2	Selection of trees and registration of lichens	56
3.3	Identification of sites	57
3.3.1	Chemistry of thallus	57
3.3.1.1.	Colour tests	57
3.3.1.2	Ultra-Violet fluorescence	58
3.3.1.3	Micro-crystalization	58
3.4	Determination of concentrations of SO <sub>2</sub> and NO <sub>2</sub> in sites	59
3.4.1	Preparation of SO <sub>2</sub> absorbing reagent	59
3.4.2	Preparation of Passive sampler for collecting SO <sub>2</sub>	59
3.4.3	Sampling of SO <sub>2</sub> in the atmosphere	61
3.4.4	Analysis of SO <sub>2</sub>	61
3.4.5	Preparation of the NO <sub>2</sub> absorbing reagent	62
3.4.6	Preparation of passive sampler for collecting NO <sub>2</sub>	62
3.4.7	Sampling of NO <sub>2</sub> in the atmosphere	62

3.4.8	Analysis of NO <sub>2</sub>	62
3.5	Recording of land use pattern of sites	63
3.6	Recording of traffic densities of sites	64
3.7	Measuring of micro-climatic conditions	64
3.7.1	Measuring of bark pH	65
3.7.2	Detecting exposure levels of sites to the light	65
3.8	Computation of lichen diversity	65
3.9	Statistical data analysis	66
3.10	Computation of index of atmospheric purity (IAP)	68
<b>4.</b>	<b>RESULTS</b>	
4.1	Identification of lichens	69
4.1.1	Sexual reproductive structures	69
4.1.2	Micro-crystallization	70
4.1.3	Identified lichens	71
4.1.4	Some sensitive lichens identified in the study	73
4.2	Summary of site data	74
4.3	Mean comparison of lichen diversity index	76
4.4	Correlation of lichen diversity index with SO <sub>2</sub> and NO <sub>2</sub> levels and substrate pH	79
4.5	Principal Component analysis (PCA)	80
4.6	Distribution of sensitive lichens	83
4.7	Index of atmospheric purity (IAP)	84

<b>5.</b>	<b>DISCUSSION</b>	
5.1	Lichen diversity	88
5.2	Levels of pollutants	90
5.3	Mean comparison	91
5.3.1	Land use pattern	91
5.3.2	Traffic density	94
5.3.3	Exposure level to the light	95
5.4	Correlation between atmospheric SO <sub>2</sub> , NO <sub>2</sub> , pH of the substrate and lichen diversity	95
5.5	Principal component analysis (PCA)	97
5.6	Index of Atmospheric purity (IAP)	99
<b>6.</b>	<b>CONCLUSIONS</b>	101
<b>7.</b>	<b>REFERENCES</b>	102
<b>8.</b>	<b>APPENDICES</b>	114



## LIST OF TABLES

Table 3.1	Descriptions of sites	54
Table 4.1	Identified lichen genera and families.	71
Table 4.2	Summary of the result of parameters considered in the study.	74
Table 4.3	Mean comparison for diversity index across different land use patterns in the study area.	76
Table 4.4	Mean comparison of lichen diversity indices across different traffic loads in the study area.	77
Table 4.5	Mean comparison of lichen diversity indices across different exposure levels in the study area	78
Table 4.6	The relationship between the lichen diversity indices SO <sub>2</sub> and NO <sub>2</sub> concentrations, bark pH of <i>Cocos nucifera</i> , bark pH of <i>Magnifera</i> spp. and bark pH of <i>Artocarpus heteroplyllus</i> .	79
Table 4.7	The summery of the principal component analysis of eight (8) environmental parameters.	80

## LIST OF FIGURES

Fig: 3.1	Map of the surveyed area showing locations of 31 sites studies.	53
Fig: 3.2	Quadrante marked on tree trunk.	56
Fig: 3.3	Design of the passive sampler.	60
Fig: 4.1	Biplot produced by plotting the principal component 1 with principal component 2	83
Fig: 4.2	The trend of the changers in number of sensitive lichen taxa along six transects.	84
Fig: 4.3	Changers of the concentrations of SO <sub>2</sub> , NO <sub>2</sub> and the IAP values along six transects.	85

## LIST OF PLATES

Plate 3.1	Google earth map showing six transects considered in the study area	52
Plate 3.2a	Passive sampler	60
Plate 3.2b	Diffuser of passive sampler	60
Plate 3.3	Wind shield with the passive sampler fixed on the tree bole.	60
Plate 4.1.a	Apothecia	69
Plate 4.1.b	Perithecia	69
Plate 4.1.c	Lirellate apothecia	69
Plate 4.1.d	Cross section of apothecium showing spores.	69
Plate 4.1.e	Asci with ascospores	69
Plate 4.2.a	Micro-crystals produced by lecanoric acid with GE	70
Plate 4.2.b	Micro crystals produced by lecanoric acid with G.A.W	70
Plate 4.3.a	<i>Leptogium</i> sp.	73
Plate 4.3.b	<i>Coenogonium</i> sp.	73
Plate 4.3.c	<i>Roccella</i> sp.	73
Plate 4.3.d	<i>Pertusaria</i> sp.	73
Plate 4.3.e	<i>Parmotrema</i> sp.	73
Plate 4.3.f	<i>Coccocarpia</i> sp.	73

## ACKNOWLEDGEMENTS

This is to express my sense of gratitude to all those who have helped me to complete this research project successfully.

First of all, I wish to express my sincere thanks to Prof. S.C. Wijeyaratne, Head of the department of Botany, University of Sri Jayewardenepura, for encouraging me to do this research, for her invaluable guidance and advise, and kind cooperation rendered to me during course of this study.

I am also grateful to Prof. H.G. Nandadasa, senior professor of Botany and all the other members of the staff for giving me the opportunity to carryout this project and for the guidance.

I wish to express my sincere gratitude to Mr. Samarakkody, Mr. Premasiri and Mr. Kumari Perera of National building Research Organization for assisting me in analyzing the gaseous pollutants.

I would also wish Mr. S. Somaratne, senior lecturer, The Open University of Sri Lanka, for helping and guidance given me to do the statistical data analysis, Mr. P. Dias, senior lecturer, of the department of mathematics, and Dr. Upul Subasinghe of department of Forestry and Environmental Science, for their guidance in designing of the project.

I would like to convey my gratitude to Mr. R.M.J. Hunukumbura, and Mr. Ranjith Kandambi, Mrs. Namalee Edirisinghe and Miss Amali Wahalathanthri for giving technical assistance during this study.

My sincere thanks also go to Mr. G.F. Alwis, senior staff technician, Geography Department, for providing maps.

I would like to thank Mr. Ushan Chanaka, Mr. Bhatiya, Mr. Kosala Gunawardene, Mr. Priyantha Hemachandra, Mrs. Anuja Gunasekara and Mrs. Jeewa Wijekoon and all my other colleagues and friends who encouraged me to complete this study successfully.

I must be thankful to Mrs. Samangi Hewage for taking photographs.

Finally I wish to express my sincere gratitude to my husband and parents who gave to moral support to complete this task successfully.

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**ABSTRACT**

Biological monitoring is an efficient and inexpensive method for monitoring air quality. Studies have confirmed that lichens are among the most reliable accumulators of airborne inorganic contaminants. As limited research has been done in tropics with regard to biological monitoring, a study was carried out to monitor lichen diversity and distribution in selected locations in Colombo and its suburbs.

Thirty one sites located on six radial transects diverging from Colombo Fort were selected for this study. Eight trees from three trees species, (*Cocos nucifera*, *Mangifera spp.*, and *Artocarpus heterophyllus*) within each site (1km<sup>2</sup>) were chosen for the study. Coverage and frequency of corticolous all lichens found on selected trees were recorded by using 250 cm<sup>2</sup> grids. After studying their morphology, anatomy, reproductive structures and chemistry, lichens collected were identified using keys. In addition, land use pattern, traffic density, pH of substrates, exposure levels of these sites to light were also recorded. Ambient SO<sub>2</sub> and NO<sub>2</sub> levels at each site were determined using passive samplers having filter pads coated with the absorbing reagents, ethylene glycol and acetone, for SO<sub>2</sub> and NaI, NaOH and Ethylene glycol for NO<sub>2</sub>. Data were statistically analyzed by using the mean comparison, correlation and by principal component analysis to investigate relationship between diversity of lichens and environmental parameters. Index of atmospheric purity (IAP) was determined using number and frequency of each lichen species recorded at a particular site.

Forty seven genera of lichens were identified, out of them ten genera were sensitive to air pollutants. The highest atmospheric SO<sub>2</sub> and NO<sub>2</sub> levels (48.35µg/m<sup>3</sup> and 42.825µg/m<sup>3</sup>) as well as the lowest lichen diversity (0.8374) were recorded from the site located in Colombo Fort. When land use pattern changed from village to urban and with increase of traffic density of sites, diversity of lichens reduced significantly. The relationship between diversity of lichens and levels of SO<sub>2</sub> and NO<sub>2</sub> was negatively correlated but significant only with levels of NO<sub>2</sub>. Further, a significant negative correlation was found between the pH of substrates and levels of SO<sub>2</sub> and NO<sub>2</sub>. Principal component analysis revealed that principal component 1(PC1), PC2 and PC3 explain 38%, 20% and 15% of the total variation in the data set respectively. Biplot developed by PC1 vs PC2 revealed that low lichen diversity class is clearly separated from other classes due to increased concentrations of SO<sub>2</sub>, NO<sub>2</sub>, land use pattern and the traffic density, all of which are included in PC1. Bark pH values of *Cocos nucifera* and *Artocarpus heterophyllus* that are represented by PC2 also had contributed to above grouping. Index of atmospheric purity (IAP) values increased along all transect with gradual decrease of SO<sub>2</sub> and NO<sub>2</sub> levels when moving away from the city. High IAP value indicates better air quality.

Absence of several pollutant sensitive tropical lichens and decrease of lichen diversity in sites with high levels of SO<sub>2</sub> and NO<sub>2</sub>, indicate that tropical lichens have the potential to be used as indicators in air pollution monitoring work.