

**OCCURRENCE AND DISTRIBUTION OF FUNGI IN A MANGROVE FOREST  
AT SIARGAO ISLAND, PHILIPPINES**

---

**A Thesis Presented to the  
Graduate Faculty of the Department of Biology  
University of San Carlos  
Cebu City**

---

**In Partial Fulfillment  
of the Requirements for the Degree  
MASTER OF SCIENCE IN BIOLOGY**

---

**By**

**Antonette D. Besitulo**

**April 2002**

2249255  
**UNIVERSITY OF SAN CARLOS  
LIBRARY**

**APPROVAL SHEET**

This thesis entitled **OCCURRENCE AND DISTRIBUTION OF FUNGI IN A MANGROVE FOREST AT SIARGAO ISLAND, PHILIPPINES** prepared and submitted by **ANTONETTE D. BESITULO** in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE IN BIOLOGY** has been examined and is recommended for acceptance and approval for **ORAL EXAMINATION**

**THESIS COMMITTEE**

*Neriza C. Arche*  
NERIZA C ARCHE, M S  
Adviser

*Daniilo B. Largo*  
DANILO B LARGO, Ph D  
Member

*Lawrence M. Liao*  
LAWRENCE M LIAO, Ph D  
Member

*Julita S. Ruelo*  
JULITA S RUELO, S Sp S, Ph D  
Member

**PANEL OF ORAL EXAMINERS**

Approved by the Committee on Oral Examination with the grade of PASSED.

*Daniilo B. Largo*  
DANILO B LARGO, Ph D  
Chair

*Julita S. Ruelo*  
JULITA S RUELO, S Sp S, Ph.D.  
Member

*Lawrence M. Liao*  
LAWRENCE M LIAO, Ph D  
Member

*Neriza C. Arche*  
NERIZA C. ARCHE, M S  
Adviser

Accepted in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE IN BIOLOGY**

Comprehensive Examination PASSED July 3, 1998

Oral Examination PASSED April 3, 2002

*Florencio L. Lagura*  
FLORENCIO L LAGURA, S V D, Ph D  
Dean, College of Arts and Sciences

PROPERTY OF USC LIBRARY SYSTEM

## ACKNOWLEDGMENT

I would like to extend my heartfelt gratitude and appreciation to

- The thesis examiners Ms Neriza C Arche, Assistant Chairman, Biology Department, University of San Carlos (thesis adviser), Dr Danilo Largo, Chairman, Biology Department, University of San Carlos, Dr Lawrence M Liao, Faculty, Marine section, Biology Department, USC, and Sister Julita S. Ruelo, S.Sp S, Faculty, Biology Department, USC for sharing their knowledge and constructive suggestions towards the improvement of this manuscript
- Dr Kevin D Hyde, Director, The Centre for Researches on Fungal Diversity (CRFD), Department of Ecology and Biodiversity, The Hong Kong University, for sharing his knowledge, for allowing me to train under him at the CRFD and for providing financial assistance. This made possible my use of the Center's facilities and library, the singular opportunity to be personally trained under his co-workers like Dr V Sarma and Dr A Alias, and varied assistance from the Center's staff and student researchers for the duration of my training
- To Mrs Bonifacia D Besitulo, Mother, for financial support of this study
- Sheila D Besitulo, Sister, for the assistance with the field work and the typing
- Dr Michele Duterte of Chong Hua Hospital and Shiela May Duterte of University of the Philippines, Fine Arts, for all the illustrations in this paper.
- Dr Stephen Pointing of CRFD, Dr Eduardo Leaño of Southeast Asian Fisheries Development Center, Mr. Sasi Nayar of the National University of Singapore, and Ms Catherine Lago of SEAFDEC and UP, Iloilo for the reference materials

- The Biology Department technicians Mr Antonio Tambuli and all his assistants, Mr Nicolas Tan, and Mr Paul Gaboya for all the various assistance provided me in the conduct of the thesis paper and the use of the department facilities And Mr. Jason Young, Faculty, Marine section, Biology Department, USC, for assistance in the making of the graphs
- The staff of IPAS-CPPAP, Siargao Island Protected Landscape & Seascape, Project Implementing Unit, Del Carmen, Surigao del Norte and the staff of the Department of Environment and Natural Resources, Dapa, Surigao del Norte for the permit to conduct field work and the reference materials
- The staff of the Philippine Fungal Diversity Research Center, Incorporated (PFDRCI) for allowing me to use their facilities for the examination of my specimen
- Mr Junior Escauso and his family for the assistance with the field work
- All those who have offered help in all aspects of the research but whose names are not mentioned herein, I give my heartfelt gratitude

Antonette D Besitulo

April, 2002

## ABSTRACT

Fixed intertidal wood from *Rhizophora apiculata*, *Xylocarpus granatum*, *Nypa fruticans*, and driftwood were collected from a mangrove forest at Siargao Island, Philippines. Wood samples were examined for the presence of mangrove fungi. The fungal species present were identified and the frequency of occurrence was recorded. Sixty-six species of mangrove fungi were collected (57 Ascomycota, 2 Basidiomycota, 7 mitosporic taxa), 46 of which are new records for the Philippines. *Linocarpon appendiculatum* had the highest frequency of occurrence. Differences in the composition of fungal species associated with *Rhizophora apiculata*, *Xylocarpus granatum*, *Nypa fruticans* and driftwood were observed. Vertical distribution was evident on *R. apiculata* and *X. granatum* samples, although few species occurred throughout the tidal range. The greatest species diversity occurred in the upper tidal level of *R. apiculata*. Temporal variation of fungi was also observed. Many of the frequently collected fungal species were present during most collection months and absent during other collection months, such as *Swampomyces* sp. nov. on *R. apiculata*, *Coronopapilla mangroveti* on *X. granatum*, *Microthyrium* sp. on *N. fruticans*, and *Antennospora quadricornuta* on driftwood. Although temporal variation was evident, some of the most frequently collected species were collected at all collection months, e.g. *Linocarpon appendiculatum*. The physico-chemical properties of the study area were observed to vary, however their effect on fungal distribution could not be fully ascertained.

## TABLE OF CONTENTS

	Page
ACKNOWLEDGMENT . . . . .	<i>ii</i>
ABSTRACT . . . . .	<i>iv</i>
TABLE OF CONTENTS . . . . .	<i>v</i>
LIST OF TABLES . . . . .	<i>vii</i>
LIST OF FIGURES . . . . .	<i>viii</i>
CHAPTER	
1 INTRODUCTION . . . . .	1
Rationale of the Study . . . . .	1
Review of Related Literature . . . . .	3
Statement of the Problem . . . . .	11
Significance of the Study . . . . .	12
2 METHODOLOGY . . . . .	14
The Study Area . . . . .	14
Collection of Wood Samples . . . . .	18
Identification, Classification and Description of Fungi . . . . .	21
Isolation . . . . .	23
Documentation of Results . . . . .	24
3 RESULTS AND DISCUSSION . . . . .	26

PROPERTY OF USC LIBRARY SYSTEM

Part I Classification and Descriptions of the Marine Fungi Found in Siargao	
Island Mangroves . . . . .	26
Key to Marine Fungi from Siargao Island, Philippines . . . . .	28
Taxonomy and Descriptions of the Mangrove Fungi . . . . .	46
Part II Occurrence and Distribution of the Marine Fungal Species . . . . .	108
Frequency of Occurrence . . . . .	108
Substrate Preference . . . . .	116
Vertical Distribution . . . . .	122
Temporal Distribution . . . . .	128
4 SUMMARY, CONCLUSION AND RECOMMENDATIONS . . . . .	134
Summary . . . . .	134
Conclusion . . . . .	137
Recommendations . . . . .	137
BIBLIOGRAPHY . . . . .	139
GLOSSARY . . . . .	148
APPENDIX	
A The G-test . . . . .	150
CURRICULUM VITAE . . . . .	152

## LIST OF TABLES

NO.	TITLE	PAGE
1	List of species of the marine fungi from Siargao Island mangroves.	26
2	Frequency of occurrence of the marine fungi collected from Siargao mangroves, Siargao, Philippines	109
3	Summary of the G-test results.	111
4	Vertical distribution of fungi on different mangrove trees of Siargao Island, Philippines.	123
5	Marine fungi collected during the five collection trips in the study area (April – December 2000).	129



## LIST OF FIGURES

PROPERTY OF USC LIBRARY SYSTEM	NO	TITLE	PAGE
	1	Map of the Philippines (A), Sargao Island (B) and an enlarged map of the mangrove area (C)	15
	2	A profile diagram showing the complex stratification of the mangrove vegetation from the seaward to the landward portion of the mangrove area	16
	3	The four different substrates A <i>Rhizophora apiculata</i> , B <i>Xylocarpus granatum</i> , C <i>Nypa fruticans</i> , and D driftwood	19
	4	Ascospores A <i>Acrocodiopsis patula</i> , B <i>Argialus grandis</i> , C <i>Argialus mangrovet</i> , D <i>Aniptodera longispora</i>	32
	5	Ascospores A <i>Antennospora quadriconnata</i> , B <i>Anthostomella nypensis</i> , C <i>Ascocratera manglicola</i> , D <i>Ascomycete</i> sp 1	33
	6	Ascospores A <i>Ascomycete</i> sp 2, B <i>Astrosphaerella striatispora</i> , C <i>Bathyscus grandisporus</i> , D <i>Caryosporiella rhizophorae</i>	34
	7	A <i>Chaetospermum</i> sp (Conidia), B <i>Coronopapilla mangrovet</i> (Ascospore), C <i>Cucullosporiella mangrovet</i> (Ascospore), D <i>Halocyphina</i> sp nov (Basidiospore)	35
	8	A <i>Halocyphina villosa</i> (Basidiospore), B <i>Halorosellina oceanica</i> (Ascospore), C <i>Halosipheta ratnagiriensis</i> (Ascospore), D <i>Helicohoidion nypicola</i> (Conidia)	36
	9	Ascospores A <i>Kallichroma tethys</i> , B <i>Lignicola longirostris</i> , C <i>Lignicola nypae</i> , D <i>Lignicola tropica</i>	37
	10	Ascospores A <i>Lineolata rhizophorae</i> , B <i>Linocarpon appendiculatum</i> , C <i>Lophiostoma mangrovet</i> , D <i>Tulworthia grandispora</i>	38
	11	Ascospores A <i>Mangrovispora pemphi</i> , B <i>Marinosphaera mangrovet</i> , C <i>Marinosphaera</i> sp, D <i>Massarina ramunculicola</i>	39
	12	Ascospores A <i>Massarina velatospora</i> , B <i>Microthyrium</i> sp., C <i>Oxydothis nypicola</i> , D <i>Passeriniella savoriellopsis</i>	40

13	A <i>Phomopsis</i> cf. <i>mangroveti</i> (Conidia), B <i>Rhizophila marina</i> (Ascospore), C <i>Salsuginea tunicola</i> (Ascospore), D <i>Savoryella longispora</i> (Ascospore)	41
14	A <i>Swampomyces</i> sp. nov. (Ascospore), B <i>Swampomyces triseptatus</i> (Ascospore), C <i>Thalassogena sphaerica</i> (Ascospore), D <i>Trichocladium alopalloneum</i> (Conidia)	42
15	Ascospores A <i>Trematosphaeria mangroveti</i> , B <i>Verruculina enalia</i>	43
16	A <i>Aniptodera chesapeakeensis</i> (Ascospore) B <i>A. intermedia</i> (Ascospore), C <i>Anthostomella</i> cf. <i>nypae</i> (Ascospore), D Ascomycete sp 3 (Ascospore), E Ascomycete sp 4 (Ascospore) F <i>Carinispora nypae</i> (Ascospore), G <i>Citrinalia pygmaea</i> (Conidia), H <i>Dactylospora haltotrephe</i> (Ascospore) I <i>Didymella</i> sp 1 (Ascospore), J <i>Didymella</i> sp 2 (Ascospore), K <i>Halosarphica marina</i> (Ascospore)	44
17	A <i>Inocarpium angustatum</i> (Ascospore), B <i>Fulworthisia</i> spp (Ascospore), C <i>Massarina</i> sp 1 (Ascospore), D <i>Massarina</i> sp 2 (Ascospore), E <i>Massarina thalassiae</i> (Ascospore), F <i>Ophioceras</i> sp (Ascospore), G <i>Phialophorophoma litoralis</i> (Conidia) H <i>Phoma</i> sp (Conidia), I <i>Vibrissia nypicola</i> (Ascospore)	45
18	Major groups of fungi collected from the mangroves of Siargao Island, Philippines	114
19	Mangrove fungi collected from <i>Rhizophora apiculata</i> and <i>Xylocarpus granatum</i>	117
20	Mangrove fungi collected from <i>N. fruticans</i> and driftwood	118
21	The vertical distribution of fungal species based on frequency of occurrence (y axis)	125
22	Temporal variations based on frequency of occurrence (y axis) of the fungi collected from <i>R. apiculata</i> and <i>X. granatum</i>	131
23	Temporal variations based on frequency of occurrence (y axis) of the fungi collected from <i>N. fruticans</i> and driftwood	132