PHILIPPINE SCIENCE HIGH SCHOOL WESTERN VISAYAS
Doña Lawa-an H. Lopez Campus
Iloilo City

A TAXONOMIC SURVEY OF MANGROVE FUNGI IN BARANGAY SOOK, AREVALO, ILOILO CITY

A Research Presented to the
Faculty of the Philippine Science High School Western Visayas
Iloilo City

In Partial Fulfillment
of the Requirements in
Science Research II

by

Helena Marie D. Lagon
Anna Patricia Paola C. Lagunilla
Jazmine Jane S. Saul

March 2001

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APPROVAL SHEET

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Abstract

The study aimed to determine the different species of mangrove fungi present on mangrove forests in Barangay Sook, Arevalo, Iloilo City, along Iloilo River.

The researchers identified and classified the collected mangrove fungi species from their phylum level to the genus and species level. The statistical tool employed in this study was the descriptive statistical testing.

Results showed that a total of seven (7) mangrove fungi species were found and identified on fifty (50) wood samples collected along Iloilo River, Arevalo, Iloilo City, namely: *Quintaria lignatilis*, *Cryptosphaeria mangrovei*-like, *Halorosellinia oceanica*, *Saccardoella marinospora*-like, *Leptosphaeria* sp., *Didymosphaeria* sp., and *Aniptodera longispora*.

Among these species, the most abundant were *Halorosellinia oceanica*, *Saccardoella marinospora*-like, and *Didymosphaeria* sp.

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A TAXONOMIC SURVEY OF MANGROVE FUNGI IN BARANGAY SOOK, AREVALO, ILOILO CITY

Chapter 1

Introduction to the Study

Background of the Study

Mangroves are considered as one of the most biologically productive areas in the world. Nutrients and runoff materials from the land are converted into living matter that sustain the diverse organisms that live, seek refuge, spawn/breed or simply feed until they develop into advanced stages of life and migrate either to the sea or land (Baldevarona, 1990 in Samaniego, 1997).

Mangrove vegetation contributes to the primary production to the aquatic environment in the form of leaf and litterfall. Decomposition of this organic material by bacteria and fungi results in protein enriched fragments of detritus. Fungi rather than bacteria have been considered to be the principal source of this increase in nitrogen (Odum and Heald, 1975; Alias, Kutherbutheen and Jones, 1995 in Samaniego). This decomposition of organic material, mainly wood, by marine fungi has recently become a focal point of research (Hyde, 1988).

Marine mangrove fungi may be defined as species that are repeatedly isolated or collected from mangrove substrata from the sea or brackish water and are able to sporulate under these conditions. Most studies have concentrated on lignocellulosic materials (decorticated woods, roots pneumatophre and bark) and less on herbaceous materials. However, ecological studies are still wanting since most of this are on descriptions of new species without consideration to ecological parameters (i.e., temperature, salinity, pH, host and nature of substrata) were usually considered in studying marine fungi.

The banks of the Iloilo River have been lined with mangrove forests for many years now. The presence of such mangrove forests may indicate diverse communities of mangrove fungi that breed and thrive in the area. Since little study has been conducted on the river regarding mangrove fungi taking refuge in the mangrove forests along the Iloilo River, specifically in Barangay Sook, Arevalo, Iloilo City, it would be best to take the lead in initiating similar studies along the area.

The independent variables in this study are the mangrove forests in Arevalo, Iloilo City, while the dependent variable is the mangrove fungi classification.

To show the relationship between the independent and dependent variables in this study, the research paradigm is presented in Figure 1.

INDEPENDENT VARIABLE DEPENDENT VARIABLE

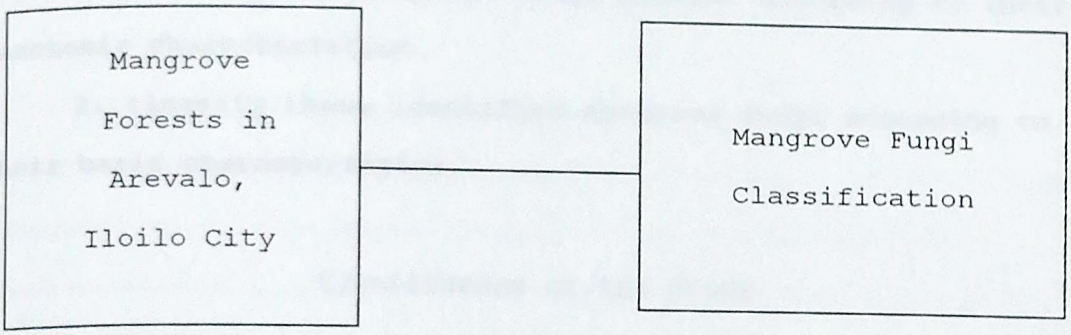


Figure 1. Classification of mangrove fungi present in wood samples from mangrove forests in Brgy. Sook, Arevalo, Iloilo City.

Statement of the Problem

This study aimed to determine the different species of mangrove fungi present on the mangrove forests in Barangay Sook, Arevalo, Iloilo City (along Iloilo river).

Specifically, the objectives of the study were to:

1. identify the mangrove fungi present according to their taxonomic characteristics.

2. classify these identified mangrove fungi according to their basic characteristics.

Significance of the Study

The list of species would provide additional record on the occurrence of mangrove fungi in the Philippines and more specifically along Barangay Sook Arevalo of the Iloilo River. This study would provide additional information on the ecology of mangrove fungi especially in the tropics.

Identification of the marine fungi species and its properties would lead to the preservation of the river and hopefully, the planting of more mangroves along the still bare banks of the river. Since most fungi may help in the decomposition of wastes, the researchers would like to open the

doors in the conservation and preservation in one of the gems of Iloilo, the Iloilo River.

Definition of Terms

For the purpose of clarity and single-mindedness, the following terms were given their conceptual and operational definitions:

Taxonomy- is the systematic arrangement of plant and animal organisms according to accepted diagnostic criteria that determine their assignment to each of the following major groups, beginning with the most inclusive: kingdom, phylum or division, class, order, family, genus and species (Webster Comprehensive Dictionary Encyclopedic Edition, 1996).

In this study, "taxonomy" meant the systematic classification of mangrove fungi that the researchers identified from wood samples collected in Brgy. Sook, Arevalo, Iloilo City along the Iloilo River in the genus and species level.

Genus- a taxonomic class or category of plants and animals ranking next above the species and next below the family or subfamily (Webster Comprehensive Dictionary Encyclopedic Edition).

In this study, "genus" was used as defined.

Species- is the category of animals or plants subordinate to a genus but above a breed, race, strain, or variety. The species name follows immediately after the name of the genus to which it belongs, and with it forms the scientific name of the individual plant or animal (Webster Comprehensive Dictionary Encyclopedic Edition).

In this study, "species" was used as defined.

Fungi- are any of the eukaryotic organisms of the Kingdom Fungi, which lack chlorophyll and vascular tissue (American Heritage Dictionary: Third Edition, 1992).

In this study, "fungi", part of the Kingdom Fungi, are those organisms collected and gathered from wood samples of mangroves along the Iloilo River, specifically in Brgy. Sook, Arevalo, Iloilo City.

Mangrove- is any of several tropical evergreen trees or shrubs having stilt-like roots and stems and forming dense thickets along tidal shores (American Heritage Dictionary: Third Edition).

In this study, "mangroves" in Brgy. Sook, Arevalo, Iloilo City along the Iloilo River are the sites for collection of mangrove fungi.

Study site- is a plot of ground set apart to be examined or to be searched into (Webster Comprehensive Dictionary Encyclopedic Edition).

In this study, "study site" was along the Iloilo River specifically in Brgy. Sook, Arevalo, Iloilo City where the researchers conducted their study.

Sampling site- is a plot or ground set apart to be examined or to be searched into (Webster Comprehensive Dictionary Encyclopedic Edition).

In this study, "sampling site" was the place where the researchers collected wood samples to be examined.

Scope and Delimitation

The scope of this study was to identify the mangrove fungi present according to their taxonomic characteristics and to classify these identified mangrove fungi according to their basic characteristics in the mangrove forests of Brgy. Sook in Arevalo, Iloilo City. The independent variables in this study are the mangrove forests in Arevalo, Iloilo City, while the dependent variable is the mangrove fungi classification.

The researchers identified and classified the collected mangrove fungi species from their phylum level to the genus and species level.

Mangrove fungi species from mangrove forests were collected randomly on December 2000.

Chapter 2

Review of Related Literature

Chapter 2, Review of Related Literature, is divided into two (2) parts, namely: (1) Mangrove Fungi, (2) Classifications of Fungi.

Mangrove Fungi

Fungi, or Mycota, is a group of spore-bearing organisms, often plantlike in appearance but lacking chlorophyll (the green pigment of plants) and true stems, roots, and leaves (Collier's Encyclopedia, 1995). The most familiar ones are bread mould, which illustrates the typical many-branched body of the organism, called the mycelium, made up of thread-like hyphae; and mushrooms, which are the sexually reproductive fruiting bodies of an underground mycelium. Fungi have, in the past, generally been classified as part of the Plant Kingdom. On a more modern view the group is better regarded as a Kingdom in its own right, with two divisions: Myxomycota, which includes the slime moulds, and Eumycota, the true fungi, which includes all the branching fungi and a few other organisms, such as yeast, that are allied to them. There are about 45,000 species of true fungi in about 5,100 genera (New Age Encyclopedia, 1983). The Division Eumycota, five major groups, or subdivisions are recognized: the Mastigomycotina, Zygomycotina,

Ascomycotina, Basidiomycotina, and Deuromycotina (Collier's Encyclopedia, 1995).

The systematic study of fungi is only 250 years old, but the manifestations of this group of organisms have been known for thousands of years---ever since the first toast was proposed over a shell full of wine, and the first loaf of leavened bread was baked. Fungi play such an important role in the slow but constant changes taking place around us because of their ubiquity (Cooke, 1975 in Alexopolous and Mims, 1979) and their astonishingly large numbers. Specifically, fungi are the agents responsible for much of the disintegration of organic matter as such they affect us directly by destroying food, fabrics, leather, and other consumer goods manufactured from raw materials subject to fungal attack; they cause the majority of known plant diseases, and many disease of animals and of humans, they are the basis of a number of industrial processes involving fermentation; they are the employed in the commercial production of many organic acids, of some drugs such as ergometrine and cortisone and some vitamin preparations, and are responsible for the manufacture of a number of antibiotics, notably penicillin and griseofulvin (Alexopolous and Mims).

Fungi are both destructive and beneficial to agriculture. On the one hand they are responsible for millions of dollars' damage to crops by causing plant disease, yet in their role as

saprobes, fungi---together with bacteria---have been responsible for millions of years for the recycling of many important chemical elements that, without their activity, would remain forever locked up in dead plant and animal bodies. Many fungi are particularly important in the decomposition of plant debris of their ability to utilize cellulose. Plant nutrients are thus released into the soil in from available to growing plants and CO_2 in large quantities is added to the atmosphere to be used in photosynthesis. Finally, to introduce an epicurean theme, we must not overlook the delights of a thick, juicy steak "smothered"---as the chefs would have it---with the sporophores of *Agaricus brunnesens,* the cultivated mushroom (Malloch, 1976 in Alexopolous and Mims).

The fungi are no longer the private concern of the mycologists. Cytologists, geneticists, and biochemists have found that fungi can be important research tools in the study of fundamental biological processes. Because of the rapidity with which some fungi grow and reproduce, a much shorter time is required to obtain a number of generations of fungi than of plants or animals. Furthermore, because fungal spores produced by meiosis will grow into haploid individuals this gives geneticists an opportunity for direct and rapid tetrad analysis. In addition, fungi, which can be grown in test tubes, require

less space, less care, and less expensive equipment than most plants and animals (Alexopolous and Mims).

Undoubtedly, many more fungi have contributions to make to knowledge and, consequently, the welfare of humans. Some are already known; others await discovery.

Mycota can be divided into terrestrial and aquatic, and under aquatic can marine fungi be associated with. About 250 species of molds, yeast, and other fungi that live in the sea have been identified. They resemble seaweeds in that they lack true roots, stems, and leaves. Marine microorganisms play an important ecological role in the process of biological production and cycling of material in marine environments.

Mangrove inhabiting marine fungi were first reported from mangrove roots in Australia by Cribb and Cribb (1955). Majority of which belong to ascomycetes. Since then, there has been a considerable increase in the information of mangrove fungi (Luna, 1999). It is now recognized that mangrove fungi constitute the second largest ecological group of the marine fungi. There were recordings with no attempt made to relate frequencies of occurrence as well as their abundance on a specific host or locality (Hyde and Jones, 1988). Little is known of the fungi colonizing herbaceous mangrove species of their associates (e.g. *Acrostichum speciosum Willdenov*, *Acanthus ilicifolius*). Mangrove fungi have only been recently studied in Hong Kong (Vrijmoed, 1990; Hyde, Vrijmoed, Chinnaraj and Jones,

1992; Vrijmoed, Hyde and Jones, 1994a,b; Jones, Vrijmoed, Read and Moss,1994; Sadaba, Vrijmoed, Jones and Hodgkiss, 1995).

The list of mangrove fungi now includes 372 species, comprising 283 ascomycetes, 83 deuteromycetes, and 6 basidiomycetes. These figures reflect a considerable increase in the number of species and hosts studied since the earlier compilations of Kohlmeyer and Kohlmeyer (1979), Hyde and Jones (1988) and Hyde (1990a) listing 42, 90 and 120 species, respectively.

At present, 42 mangrove hosts have been examined for the presence of marine fungi (Sadaba, 1996). Among the 42 mangrove hosts studied, *Nypa fruticans* yielded the highest number of additional species recorded (41 species [Hyde, 1992f]) compared to only 8 species in 1989 (Hyde and Nakagiri, 1989), though not all the additional species are new to science. Finally, some species are rarely recorded from mangroves (e.g. *Halonectria milfordensis* Jones and *Remispora quadriremis* Linder).

A comparison of the data on the occurrence of marine fungi obtained from the different locations and species hosts shows difference in species composition with respect to the hosts. In general, the most common fungi varied in each location. A number of factors which may affect species composition in a given site have been identified by Kohlmeyer and Kohlmeyer (1979) and Hyde and Jones (1988). These include salinity, mangrove tree species, position in the intertidal region, nature of the mangrove floor (mud or sand), pH of water, geographical

location of the oceanic region and whether the substratum is driftwood or standing roots and branches (Sadaba, 1996). Hyde (1989b) suggested that more studies should be undertaken to investigate the effect of salinity on the frequency of occurrence of intertidal mangrove fungi with respect to their succession, host distribution, and vertical distribution.

Many recent publications reporting on the old world mangroves in the Pacific and Indian Oceans showed that mangrove fungi are distributed across the tropical world (Patil and Borse, 1983, 1985; Hyde, 1986 in Samaniego, 1997). Mangrove tree species differ in the new and old world regions. Species common to the Atlantic Ocean mangroves are now known to be common in both the Pacific and Indian Oceans (Tomlinson, 1986 in Samaniego, 1997). Only a few species are known from the single oceanic region and many of these have only recently been described (Hyde and Jones, 1996 in Samaniego, 1997).

Classifications of Fungi

The classification of the fungi is based on the type of spores produced (and spores can be produced either sexually or asexually) and on the form of the specialized spore-bearing structures. The different ranks, or levels or groupings within the fungi classification are indicated by standardized name endings, as recommended by the International Rules of Botanical Nomenclature for the fungi (Collier's Encyclopedia).

Taxonomy has a dual purpose: first, to name organisms according to some internationally accepted system so that, with the least possible amount of confusion, mycologists may communicate to each other their findings concerning a certain fungus; second, to indicate the current concept of the relationships of fungi to each other and to other living organisms (Alexopolous and Mims).

According to these recommendations, the name of a division, which is the largest, or most comprehensive, grouping in the fungi kingdom (equivalent to a "phylum" in the animal kingdom), should end in *-mycota,* whereas the name of a subdivision (the major unit within a division) should end in *-mycotina.* Similarly, the name of a class (the major unit within a subdivision) should end in *-mycetes*, the name of an order in -ales, and the name of a family in *-aceae;* there are no standardized name endings for the genus or species. There is no universal agreement among mycologists on classification of the fungi, and the various proposed classifications divide and aggregate the fungi in different ways, using new group names or changing the endings of previous names to conform to a group's new ranking within that particular classification. Division Eumycota is divided into five (5) major groups, or subdivisions: the Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, and Deuteromycotina (Collier's Encyclopedia).

Mastigomycotina

These are mainly aquatic fungi that sexually produce motile, or self-propelling, spore, technically called zoospores (pronounced zo-ah-spores). The mastigomycotines can be divided into three classes according to the type of zoospore produced 9zoospores vary in such features as the number and position of whiplike flagella used for locomotion). The best-known class, and the only one discussed in this brief survey, is the Oomycetes, which contain the water molds, or saprolegniales (order Saprolegniales). The saprolegniales are economically important as parasites of fish and their eggs and are frequently observed as a mycelial fringe around dead fish floating in rivers or lakes. The oomycetes also include several forms in the genera

Pythium, *Phytophthora*, and *Peronospora* that cause destructive plant diseases. Species of *Pythium* are the cause preemergence killing, root rot, and damping-off (plant rot) of seedlings growing in poorly drained soils and are often a serious problem in nursery beds and greenhouses. *Phytophthora infestans* is historically notorious as the cause of late blight of potato; this plant disease was responsible for the devastating potato famine in Ireland between 1845 and 1847, resulting in a reduction in the Irish population by more than 1.5 million and in a large-scale emigration to North America. *Peronospora* and related genera, collectively known as downy mildews, are

frequently the cause of major losses during the cultivation of crops such as onions and lettuce (Collier's Encyclopedia).

Zygomycotina

The zygomycotines are terrestrial fungi that reproduce asexually by means of nonmotile spores (technically termed aplanospores) and sexually by the fusion of two "sex-organ" structures called gametangia, which arise from the mycelia. The aplanospores are produced in sac-like structures called sporangia and sometimes are violently projected into the air. In sexual reproduction two gametangia fuse and their cell contents mix, eventually to form a thick-walled spore called a zygospore.

Zygospores are resting spores, undergoing a period of dormancy before they can germinate. The genus *Mucor* and related forms are common representatives of these fungi and are abundant in soil and in dung and also appear as furry growths on damp bread or rotting fruit. There is considerable variation in the structure of the spore-producing sporangium and in the precise method of zygospore development, and these variations are used to distinguish the different genera. Many zygomycotine species are also heterothallic, that is, individual fungi of these species are self-sterile, the formation of zygospores requiring not only two different fungi but fungi of compatible mating

types, or strains (designated + and -). Interaction between compatible strains is coordinated through chemical (hormonal) attraction (Collier's Encyclopedia).

Ascomycota

The ascomycetes constitute the largest of the fungal subdivisions. They are characterized by the formation of a particular type of sexually produced spore, termed an ascospore because it is produced within a sac-like cell known as an ascus (from the Greek *askos*, "container"). The presence of these sac-like cells has led to the Ascomycotina being called the sac fungi. Typically, eight ascospores are formed within an ascus, but the number can vary from one to more than a thousand, depending on the species. A layer formed by these spore-bearing asci, often with threadlike hairs mixed among them, is called a hymenium (plural, hymenia). In most ascomycotines the asci (or hymenial layers) are embedded within a mass of hyphae, and the combined hyphae-asci structure forms a fruiting body called an ascocarp. Ascocarps are intricate structures that provide many valuable features for the classification of these fungi. Most ascomycotines also produce nonmotile asexual spores called conidiospores or conidia (meaning "little particles of dust," from the Greek *konis*, dust, and *-idion*, a suffix indicating smallness). Conidia arise either from ordinary body (somatic) hyphae or, more usually, from cells at the tips or sides of

specialized hyphae called conidiophores (Collier's Encyclopedia).

Ascomycetes have a septate mycelium and produce sexual spores in structures called asci. This subdivision includes yeasts, mildews, blue-green moulds, such as *Penicillium*, and many forms with bright-coloured fruiting bodies (New Age Encyclopedia).

The Ascomycotina occupy many habitats, occurring in soil, marine and fresh water, and on decomposing plant and animal remains. They also are important pathogens, or causative agents, of both plant and animal diseases.

In classifying the various fungi within this largest of the fungal subdivisions, mycologists have traditionally recognized five major groups, or classes: Hemiascomycetes, Plectomycetes, Pyreomycetes, Discomycetes, and Loculoascomycetes. Introduction of new data, however, from such advanced procedures as electron microscopy and DNA typing (analysis of genetic material), has indicated that these traditional groupings may not precisely reflect true evolutionary relationships (Collier's Encyclopedia).

The plant parasitic Ascomycetes, many of which develop their spores in the dead leaves of their hosts, can be best collected in early spring when their spores are mature and about to be released. Others, such as the saprobic cup fungi, can be found in the woods throughout the growing season. For some species, such as the morels, the fruiting season is short, not

exceeding three or four weeks. Marine Ascomycetes may be saprobic on various types of organic material submerged or floating in marine waters or may be parasitic on marine algae and angiosperms.

Many Ascomycetes are beneficial. The fermenting activities of certain yeasts are the basis of the baking and brewing industries. The morels and truffles also enjoy a fame of special importance among the fungi, for discriminating eaters consider them second to none in delicacy of flavor.

In the absence of convincing fossil evidence, the relationships among the Ascomycetes remain obscure. Their taxonomy is presently in a state of flux and so many researchers are investigating the group developmentally that it is no exaggeration to say that no two specialists agree completely on the classification of this large group of fungi (Alexopolous and Mims).

Basidiomycota

The production of basidiospores on basidia during sexual reproduction is the fundamental feature of Basidiomycotina. A basidium can be thought of in its basic sense as the swollen terminal cell of a hypha specialized to produce spores on its outside, each spore (basidiospore) being attached to the outer surface of the basidium by a delicate stalk.

The Basidiomycotina contain many fungi whose large, fleshy fruiting bodies are generally called mushrooms, including those

more specifically known as bracket fungi, puffballs, earth stars, stinkhorns, and jelly fungi (the term "toadstool" is imprecise, for it can refer either to any mushroom, that is, any fungus with an umbrella-like cap, or only to an inedible or poisonous one). Most of the basidiomycotines are saprotrophs and play a vital role in the decomposition of litter, wood, and dung. However, *Serpula lacrymans* is the very destructive dry-rot fungus, and *Armillaria mellea* is an important pathogen of many plant species. A number of mushrooms are good to eat, such as the cep or penny bun, Boletus edulis, and the chantarelle, *Cantharellus cibarius,* both of which are highly priced. There also are a number of poisonous species, the death cap, *Amanita phalloides,* being one of the best known, while others, such as the liberty cap, *Psilocybe semilanceata,* and the fly agaric, *Amanita muscaria,* are well known for their hallucinogenic properties.

It is usual to recognize three classes of basidiomycotines on the basis of basidia development. The class Hemibasidiomycetes contains the rusts (order Uredinales) and smuts (order Ustilaginales); both are important plant pathogens. The rusts have a long fossil history and were probably parasitic on ferns during the Carboniferous period, some 300 million years ago. The class Hymenomycetes includes the agarics (gill fungi), boletes (pore fungi), and polypores (bracket fungi). The class

Phragmobasidiomycetes contains the jelly fungi (order Tulasnellales) (Collier's Encyclopedia).

Deuteromycota

This group is also known as the fungi imperfecti because its members have no known sexual phase (in botany "perfect" means "complete," or with all sexual parts, and in mycology it refers to having a sexual reproduction state, also called a teleomorphic state). The Deuteromycotina are often referred to as a "wastebasket" group in which many different kinds of fungi apparently lacking a sexual state are deposited. Because these fungi lack sexual state, the systematic arrangement of deuteromycotine species is based on their asexual spores, or conidia. Because some researchers are not aware that a sexual state exists in a particular fungus, it is not unusual for a fungus to be classified in two different subdivisions, in the Deuteromycotina as an imperfect (or anamorphic) form and, for example, in the Ascomycotina as a perfect (or teleomorphic) form (Collier's Encyclopedia).

Summary

Fungi thrive abundantly around us. They used to be classified under the Plant Kingdom since they were plantlike in appearance. However, they lack some characteristics like chlorophyll and true stems, roots, and leaves. Presently, fungi

are regarded as one kingdom with two divisions, Myxomycota and Eumycota. Fungi can also be divided into terrestrial and aquatic.

Mangrove fungi can be classified under aquatic. It is now recognized that mangrove fungi is the second largest ecological group of the marine fungi.

Chapter 3

Research Design and Methodology

This study aims to gather information on the mycota of mangroves along Iloilo River, specifically in Barangay Sook, Arevalo, Iloilo. Specifically, the objectives of the study are to identify the mangrove fungi present according to their taxonomic characteristics and classify these identified mangrove fungi according to their basic categories.

Materials and Equipment

The materials and equipment to be used in this study will be divided into three parts: (1) Collection of Samples, (2) Examination of Samples, and (3) Identification, Classification, and Documentation.

Collection. The materials used were: resealable plastic bags (for collection samples), empty water containers (for water samples), laboratory thermometer and contact print film. The equipment used was a camera.

Examination of Samples. The materials used were: slides and cover slips, vials (for sterilized water), inoculating needles, fine forceps, and clean paper. The equipment used were: a dissecting microscope (Olympus Brand), and a light microscope (Olympus Brand).

Identification, Classification, and Documentation. The materials used were: collected fungi on slide, Lactophenol, iodine, tissue paper, and identification keys. The equipment used were: dissecting microscope (Olympus Brand), light microscope (Olympus Brand), and a photomicrograph system.

Site of Collection

The samples of mangrove fungi were collected from a mangrove forest along the Iloilo River, specifically in Barangay Sook, Arevalo, Iloilo City (Appendix 2).

Collection and Preparation of Samples

Samples were randomly collected on December 2000. They were placed inside resealable plastic bags to prevent loss of moisture while transported to the laboratory for examination.

Upon arrival in the laboratory, the samples were washed with clean running water to remove any mud or debris attached on them. They were then placed inside a resealable plastic bag lined with moistened sterile filter paper for incubation.

After one week, the samples were examined in the Microbiology Laboratory of the Division of Biological Sciences, U.P. in the Visayas, Miag-ao, Iloilo (Appendix 3).

Examination

The samples were examined under the dissecting and light microscopes (Appendix 4).

Identification of Fungi

Identification of fungi were based on the descriptions of the colony on its natural substratum, cultural characteristics and microscopic characteristics. Various taxonomic keys of identification were used as reference (Alexopoulos *et al.*, 1996; Barnett and Hunter, 1987; Larone, 1987; Hyde and Sarma, 1997; Kohlmeyer and Kohlmeyer, 1979; Onions *et al.*, 1981;).

Photomicrography

Selected species were photographed to document their morphological features.

Chapter 4

Results

This study aimed to determine the different species of mangrove fungi present on the mangrove forests in Barangay Sook, Arevalo, along Iloilo River. Specifically, the objectives of the study were to identify mangrove fungi according to their taxonomic characteristics and to classify identified mangrove fungi according to their basic categories.

Taxonomy of mangrove fungi species found along Iloilo River (Barangay Sook, Arevalo)

A total of seven (7) mangrove fungi species were found and identified on fifty (50) wood samples collected along Iloilo River, Arevalo, Iloilo City. These were *Quintaria lignatilis (10%)*, *Cryptosphaeria mangrovei*-like (8%), *Halorosellinia oceanica (80%)*, *Saccardoella marinospora*-like (64%), *Leptosphaeria* sp. (52%), *Didymosphaeria* sp.(60%), and *Aniptodera longispora (20%)*.

Table 1 shows the data.

Table 1

Overall Frequency of Occurrence of fungi associated with decomposing mangrove wood from Sitio Sook, Arevalo, Iloilo City

Fungal Species	Total Collection	Frequency Of Occurrence (%)*
Quintaria lignatilis	5	10
Cryptosphaeria mangrovei-like	4	8
Halorosellinia oceanica	40	80
Saccardoella marinospora-like	32	64
Leptosphaeria sp.	26	52
Didymosphaeria sp.	30	60
Aniptodera longispora	10	20

*Frequency of occurrence (%) = $\frac{\text{No. of collection of a species} \times 100}{\text{Total no. of samples examined}}$

Occurrence of species*: Very Frequent : > 30%
Frequent : 10-29%
Infrequent : <10%

(* Adapted from Sadaba *et al.*, 1995.)

Classification of Mangrove Fungi According to Basic Fungal Descriptions

Quintaria lignatilis. The fungus closely resembles *Quintaria lignatilis* based on the following characters used in the key (Hyde and Sarma, 1997): Spores lacking flagella, no zygospores produced; saprobic on plants including woody substrates, spores borne in asci, with several layers (bitunicate) and often releasing ascospores by fissitunicate dehiscence- Loculoascomystes. Ascomata perithecial; spores with more than 2 -cells transverse septa only, hyaline, ascomata immersed, spores 51-80 x 14-20 (22) µm, 6-celled and completely immersed in wood.

Cryptosphaeria mangrovei-like. The fungus closely resembles *Cryptosphaeria mangrovei* based on the following characters used in the key (Hyde and Sarma, 1997): Spores lacking flagella, no zygospores produced; saprobic on plants including woody substrates, spores borne in asci, with a single layer. Ascomata perithecial, 2-celled, brown, smooth ascospores.

Halorosellina oceanica-like. The fungus closely resembles *Halorosellina oceanica* based on the following characters used in the key (Hyde and Sarma, 1997): Spores lacking flagella, no

zygospores produced; saprobic on plants including woody substrates, spores borne in asci, with several layers (bitunicate) and often releasing ascospores by fissitunicate dehiscence- Loculoascomystes. Ascomata perithecial, asci with 2-8 spores, 1-celled spores 18-28 x 7.5 - 13 µm, ascomata not immersed on wood.

Saccardoella sp. The fungus closely resembles *Saccardoella* sp. based on the following characters used in the key (Hyde and Sarma, 1997): Spores lacking flagella, no zygospores produced; saprobic on plants including woody substrates, spores borne in asci, with a single layer (unitunicate). Ascomata perithecial, ascospores 4-celled, hyaline, without sheath.

Leptosphaeria sp. The fungus closely resembles *Leptospaheria* sp. based on the following characters used in the key (Hyde and Sarma, 1997): Spores lacking flagella, no zygospores produced; saprobic on plants including woody substrates, spores borne in asci, with several layers (bitunicate) and often releasing ascospores by fissitunicate dehiscence- Loculoascomystes. Ascomata perithecial, spores with more than 2-cells, transverse septate only, hyaline, ascomata immersed, spores 17-27 µm, 4-celled, long fusiform to clavate, hyaline, without sheath.

Didymosphaeria sp. The fungus closely resembles *Didymosphaeria* sp. based on the following characters used in the key (Hyde and Sarma, 1997): Spores lacking flagella, no zygospores produced; saprobic on plants including woody substrates, spores borne in asci, with several layers (bitunicate) and often releasing ascospores by fissitunicate dehiscence- Loculoascomystes. Ascomata perithecial, spores with more than 2-cells, spores brown, septum central, spores 18-23 x 9-11 µm, verrucose (with ornamentations), ascoma immersed.

Aniptodera longispora. The fungus closely resembles *Saccardoella* sp. based on the following characters used in the key (Hyde and Sarma, 1997): Spores lacking flagella, no zygospores produced; saprobic on plants including woody substrates, spores borne in asci, with a single layer (unitunicate). Ascomata perithecial, ascia with 2-8 spores, spores 2-celled, hyaline, without appendages, ascospore wall-thin, (32) -34-54 x 9-13 µm.

Chapter 5

Findings, Conclusions, and Recommendations

This study aimed to determine the different species of mangrove fungi present on the mangrove forests along Iloilo River.

Specifically, the objectives of the study were to:

1. identify mangrove fungi according to their taxonomic characteristics.

2. classify identified mangrove fungi according to their basic characteristics.

Findings

Based on the data gathered, this study was able to establish the following findings:

1. A total of seven (7) mangrove fungi species were found and identified on fifty (50) wood samples collected along Iloilo River, Arevalo, Iloilo City, namely, *Quintaria lignatilis (10%)*, *Cryptosphaeria mangrovei*-like (8%), *Halorosellinia oceanica (80%)*, *Saccardoella marinospora*-like (64%), *Leptosphaeria* sp. (52%), *Didymosphaeria* sp.(60%), and *Aniptodera longispora (20%)*.

2. All species collected, i.e., *Quintaria lignatilis*, *Cryptosphaeria mangrovei*-like, *Halorosellinia oceanica*,

Saccardoella marinospora-like, *Leptosphaeria* sp., *Didymosphaeria* sp., and *Aniptodera longispora* belong to Phylum Ascomycota.

Conclusions

Seven (7) fungal species were identified from fifty (50) wood samples collected along Iloilo River, Arevalo, Iloilo City. These species present are *Quintaria lignatilis*, *Cryptosphaeria mangrovei*-like, *Halorosellinia oceanica*, *Saccardoella marinospora*-like, *Leptosphaeria* sp., *Didymosphaeria* sp., and *Aniptodera longispora*.

Among these species, the most abundant were *Halorosellinia oceanica*, *Saccardoella marinospora*-like, and *Didymosphaeria* sp.

Recommendations

It is recommended that other mangrove areas along the Iloilo River should be surveyed for the presence of fungi. To study the influence of seasonal change in species composition between dry and wet months is also recommended.

It is also recommended that more number of collections should be made to determine influence of hydrological parameters to species composition, and lastly, the isolation of collected fungi should be done to be able to perform physiological studies

in terms of pH, salinity, and temperature effect on species collected.

APPENDIX 1

MAP OF ILOILO RIVER

APPENDIX 2

MANGROVE FORESTS IN BRGY. SOOK,

AREVALO, ILOILO CITY

APPENDIX 3

EXAMINATION OF WOOD SAMPLES

APPENDIX 4

EXAMINATION UNDER LIGHT MICROSCOPE

APPENDIX 5

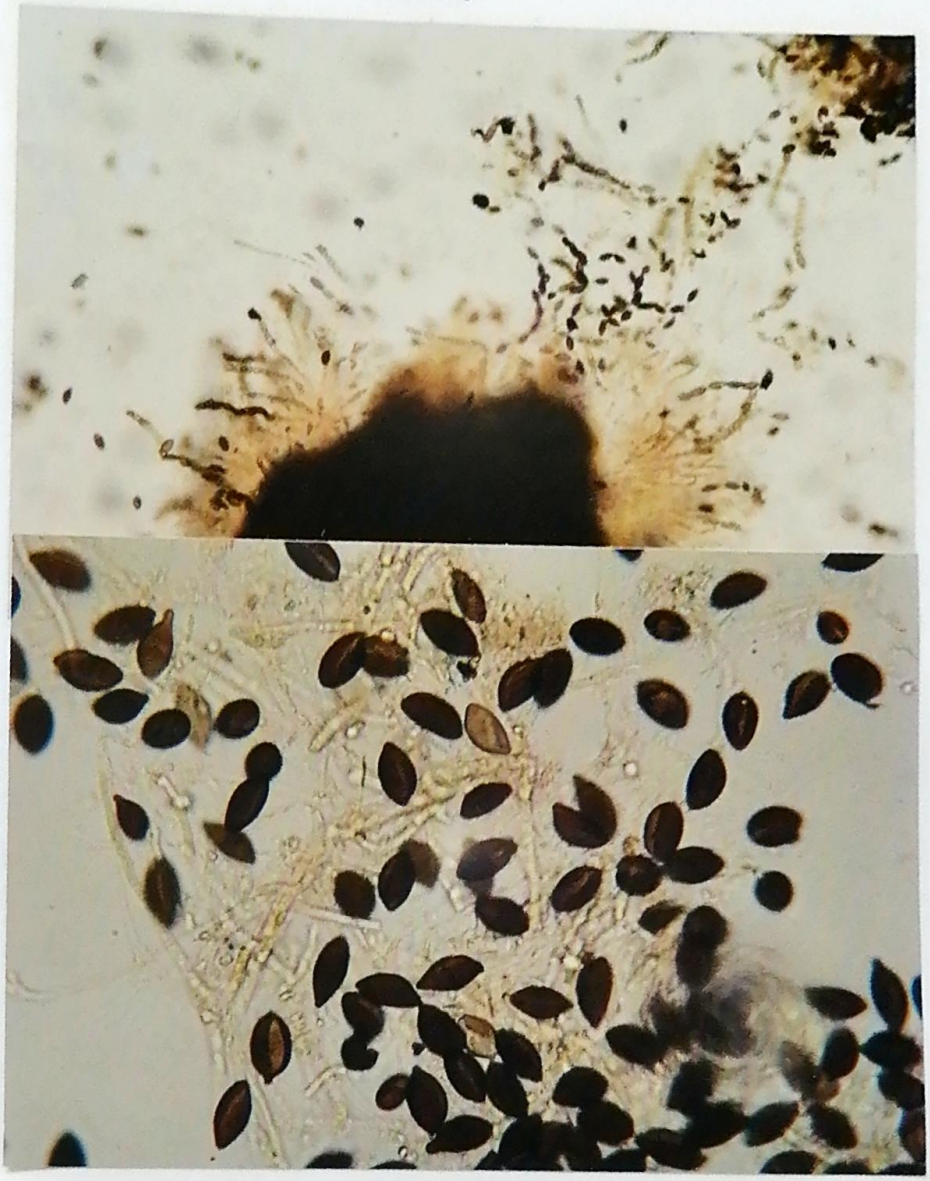
LIGHT MICROGRAPH OF

Quintaria lignatilis

APPENDIX 6

LIGHT MICROGRAPH OF

Cryptosphaeria mangrovei-like



APPENDIX 7

LIGHT MICROGRAPH OF

Halorosellinia oceanica

APPENDIX 8

LIGHT MICROGRAPH OF

Saccardoella marinospora-like

APPENDIX 9

LIGHT MICROGRAPH OF

Leptosphaeria sp.

APPENDIX 10

LIGHT MICROGRAPH OF

Didymosphaeria sp.

APPENDIX 11

LIGHT MICROGRAPH OF

Aniptodera longispora

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