A Descriptive Study on the Mixture of Sawdust, Rice Bran, Lime, and Sugar as Substrates for the Mycelial Growth of *Pleurotus sp.*

A research paper presented to the faculty of

Philippine Science High School - Western Visayas

in the fulfillment of the requirements in Science Research 2.

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Approval Sheet

This research paper entitled "A Descriptive Study on the Mixture of Sawdust, Rice Bran, Lime, and Sugar as Substrates for the Mycelial Growth of **Pleurotus sp.**" and submitted in the fulfillment of the requirements in Science Research 2 of the Philippine Science High School - Western Visayas has been examined and is recommended for approval.

May 26, 1997 — Josette J. Biyo

Date — Prof. Josette Biyo
Science Research 2 Instructor

This research paper is accepted and approved in the fulfillment of the requirements in Science Research 2.

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Date — Prof. Lilian G. Alfonso
PSHSWV Director

Abstract

The research was done to determine which concentration among the mixture of sawdust, rice bran, lime, and sugar served the best for the mycelial growth of Pleurotu sp.

There were at least two (2) replicates for each mixture and then the observations made on each medium was collaborated and took the qualitative average.

The experimental media, Pleurotus sp., was inoculated in agar and then were transferres in to the experimental media.

Mycelium grew first in the upper portion of the sealed media, making its way downward.

Set-up 4 (50% sawdust, 42% rice bran, 2% lime, 2% sugar) yielded the greatest amount of mycelial growth and thus was concluded that it was the best concentration to be used, based on the controlled set-up.

Contamination also was never neglected. It still occurred even the media were sterilized and sealed.

Acknowledgment

The group thank, first of all, the Lord for always bringing them to safety everytime they went to where the set-ups were housed.

Also, a deep appreciation to Mrs. Josette Biyo, who has been patient enough to wait for the completion of this research paper, and also for her guidance.

To Mr. Willy Fuentespina, who has been the resourceperson of the group eversince the research started.

To Mrs. Alicia Tantiado, who has been instrumental in helping the group in finding the source of the experimental subject.

To Mr. Eduardo Ongcol, who has helped the group interpret the data the group has obtained.

And to those who were not mentioned, the group was thankful enough to have you as part of the completion of both the research and the research paper.

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CHAPTER 1

Rationale of the Study

Mushrooms are fungi which do not have the green pigment called chlorophyll in them, thus not capable of producing their own food. Therefore, they should be provided with performed food such as cellulose, glucose and starch. These food substances are broken down into smaller molecules and are absorbed by the hyphae for their growth and development.

They belong to the class Basidiomycetes and order Agaricales in the fungal classification. The umbrella-like fruiting bodies are the usually fleshy fungi which composes this order. "Mushrooms" refer to these fruiting bodies.

Some species prefer shady and woody areas while others like open, well-lighted areas.

Certain seasons of the year reflect the mushrooms' preferences of temperature, humidity, and moisture, in terms of its growth. The best season to go mushroom hunting is, in the temperate regions, fall; and in the tropical regions, rainy.

But not all mushrooms are edible. Some are poisonous, yet, there are still some which are neither poisonous nor edible. In other words, these mushrooms willnot harm the consumer but it's either they are too tough or they have no taste at all.

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Mushrooms can be bought in the supermarkets or in the local stores. Despite the high cost, people still buy them for their exotic taste, whether alone or in combination with other food ingredients. However, little is known that mushrooms contain a lot of nutrients and therefore, has a vital contribution to a man's diet.

Being unable to distinguish whether a certain mushroom is edible or not, a great majority of people do not just simply eat mushrooms except those which are already known and sold in the markets. Some would even prefer imported ones.

Knowing that mushroo-growing could yield a high income, people tend to grow mushroom and continue to do so as a form of livelihood. Seminars have been conducted in various parts of the country concerning mushroom technology. People were taught how to inoculate, plant, maintain, harvest, and package, or even cook mushrooms.

In the past years, mushroom growers used different materials as substrates and followed different guidelines such as the concentration of each material, under what conditions should the mushroom be grown, and others.

Mushroom technology has been undeniably successful. It provided mushroom irregardless of the time of the year. And people will continue to plant mushroom not only for its high output cost but also for its exotic taste.

Statement of the Problem

The researchers tried to answer the following questions:

1. Did the different concentrations of rice bran, sawdust, lime, and sugar have a significant effect on the mycelial growth of Pleurotus sp?

2. Among the following concentrations, namely:

   a. 80% sawdust, 18% rice bran, 1% sugar, 1% lime

   b. 70% sawdust, 26% rice bran, 2% sugar, 2% lime

   c. 60% sawdust, 34% rice bran, 3% sugar, 3% lime

   d. 50% sawdust, 42% rice bran, 4% sugar, 4% lime

   e. 40% sawdust, 50% rice bran, 5% sugar, 5% lime

which served as the best concentration for the mycelial growth of Pleurotus sp.?

Objectives of the Study

This study was aimed at the following:

1. To compare the differences on the growth of Pleurotus sp cultured on the different media using mycelial growth as basis.

2. To determine the best concentration of rice bran, sawdust, lime, and sugar as medium for the growth of Pleurotus sp.

Importance of the Study

The research was done to determine whether or not Pleurotus sp. could grow on different media other than the conventional one which is a mixture of 80% sawdust, 18% rice bran, 1% lime, and 1% sugar. Also, it was done to determine which concentration was the most suitable for the mycelial growth of Pleurotus sp.

Hypotheses of the Study

H_a :

Significant differences will be observed on the mycelial growth of Pleurotus sp. cultured on different concentrations of sawdust, rice bran, lime, and sugar as growth media.

H_o :

No significant differences will be observed on the mycelial growth of Pleurotus sp. cultured on different concentrations of sawdust, rice bran, lime, and sugar as growth media.

Scope and Limitations

This study concentrated only in a single species as experimental subject which is Pleurotus sp. and the study considered mycelial growth as basis. The researchers limited themselves with only one factor which is the growth medium; the humidity, temperature, and moisture of the air were beyond their concern. Also, the mineral content of the media was not considered by the researchers.

The researchers did not also consider the presence of contaminants though even in the most sterile conditions, the possibility of contamination can never be negligible. The school laboratory was not yet furnished with a sterile room so contamination was a big possibility. Even sterile rooms can never guarantee a total contamination-free zone, it can only help minimize its occurence.

CHAPTER 2

Review of Related Literature

Mushroom Technology

Mushroom is the oldest single celled protein food for men. It is also the first solid state fermentation product. To date, mushroom cultivation is a major industry using cellulosic residues although several research and development studies are being undertaken for the conversion of lignocellulosic into sugars, fuels, solvents, and animal feeds, among others.

Worldwide, mushroom has always been considered as a delicacy of sorts. The Greeks considered it as a source of strength for their warriors while the Romans regarded it as "food for the gods" and served it only in special festive ocassions. Others like the Chinese treasured it as a health food and is a common culinary ingredient.

In early times, mushrooms were collected from natural growing habitats. At present, practical cultivation methods are already developed that would ensure a continuous, steady, and safe supply of edible mushrooms.

What are Mushrooms?

Mushrooms are fungi and as such, they don´t have any green chlorophyll bodies that help manufacture their own food. Mushrooms like all other fungi should be provided with perfomed food such as cellulose, glucose, and starch which with the help of the enzymes they produce, are broken down into smaller molecules and are absorbed by the hyphae for their growth and development.

Mushrooms belong to the Class Basidiomycetes and Order Agaricales in the fungal classification. This order is composed of fungi, forming fleshy, usually umbrella-like fruiting bodies. The term "mushrooms" refer to these fruiting bodies.

The Agaricales are widely distributed and occur in a variety of habitats. Like other fungi, they may be found in temperate as well as tropical types of habitats. For example, some species prefer shady and woody areas while others like open, well-lighted areas. Within a certain habitat, mushroom also show preference to certain substrates. Some are wood-inhabiting, other follicolous(on dead leaves), still others coprophilous(on dung).

Mushroom grows on certain seasons of the year and this reflect their particular preference of tempera-

ture, humidity, and moisture. Generally, fall in the temperate regions and the rainy seasons in the tropical regions are the best seasons of the year to go mushroom hunting.

Pleurotus sp.

Pleurotus mushrooms is one of the edible mushrooms that can be cultivated in the tropics, although it is more sub-tropical. Like other mushrooms, it contains a lot of protiens, minerals, and vitamins which are essential for the maintenance of good health. It is also cultivated in Europe where it is known as oyster mushroom (*P. ostreatus*), and in China, where they call it abalone mushroom (*P. abalonus* or *P. cystidiosus*). Several other species are now available for cultivation. There is *P. sajor-cuja* (originally from India), *P. florida* (probably at different strain of *P. ostreatus*) and *P. flabellatus* (from the Philippines).

The above species of *Pleurotus* sp. are suited for growing in conditions ranging from 15 to 32 °C. *P. sajor-cuja* has been tested to be the most resistant to the tropical climate of 28 to 32 °C, although they still fruit faster and bigger at 22 to 26 °C during the cooler months of the year. *P. abalonus* prefers lower temperature of 22 to 26 °C while *P. austreatus* are the so-called low temperature Pleurotus, fruiting mostly at 15

to 20 °C, hence suited to the temperate climate of Europe and USA.

Like other mushrooms, Pleurotus can be grown in various ways using various agricultural waste material. It can be grown in a mixture of sawdust and rice bran, rice straw and bran, sawdust and ipil leaves, and other various combinations. Other waste like corn cobs, cotton hulls, waterlily leaves, and others are also good substrates for growing mushrooms.

The Mushroom as a Nutritious Food Item

The popularity of mushrooms is not much on the nutrients that they have but mostly on the exotis taste they impart, whether alone or in combination with other food ingredients. Little however is known that mushrooms are full of nutrients and can therefore make a very important contribution to the nutrition of man.

Their protien content is highly comparable to any common vegetables. Although they can't compete with meat, fish, and eggs, their protein content is almost equal to corn, milk, and legumes and definitely higher than other leafy and root vegetables and fruits.

Mushroom also rank quite highly for their vitamin content. Although devoid of vitamin A. mushrooms make up their high riboflavin, thiamine, and nicotinic acids. They are also good sources of essential minerals

such as calcium and phophorous. Low in cholesterol and calories, mushrooms are often refered to as "slimming food".

Harvesting

Three to four days after opening the bags, mushrooms primordia will start to form and this will be ready in another two more days. If the bags are not too mature enough, it will take longer time.

When harvesting, grasp the stalk of the mushroom and gently pull it out. Don't use a knife. If kept in a refrigerator or a cool place, it will stay fresh up to three to six days.

CHAPTER 3

Methodology

1.) Test organism

The test organism was obtained from Brgy. Buray, Oton, Iloilo. Pleurotus sp. was cultured in agar and planted in the prepared media. The quantity of the test organism used in each set-up was one (1) gram. The researchers waited and constantly checked the set-up to observe any change in the mycelial growth as well as for the occurence of contamination.

2.) The experimental media

The experimental media were composed of four set-ups with different concentrations, namely:

a. 70% sawdust, 26% rice bran, 2% lime, 2% sugar

b. 60% sawdust, 34% rice bran, 3% lime, 3% sugar

c. 50% sawdust, 42% rice bran, 4% lime, 4% sugar

d. 40% sawdust, 50% rice bran, 5% lime, 5% sugar

Sawdust was obtained from a lumberyard in Jaro, Iloilo City; rice bran, from a poultry supply; lime and sugar, from a local store in Jaro market.

A set-up whose concentration was 80% sawdust, 18% rice bran, 1% lime, 1% sugar was not considered as one of the experimental media because it's the conventional concentration used by mushroom growers.

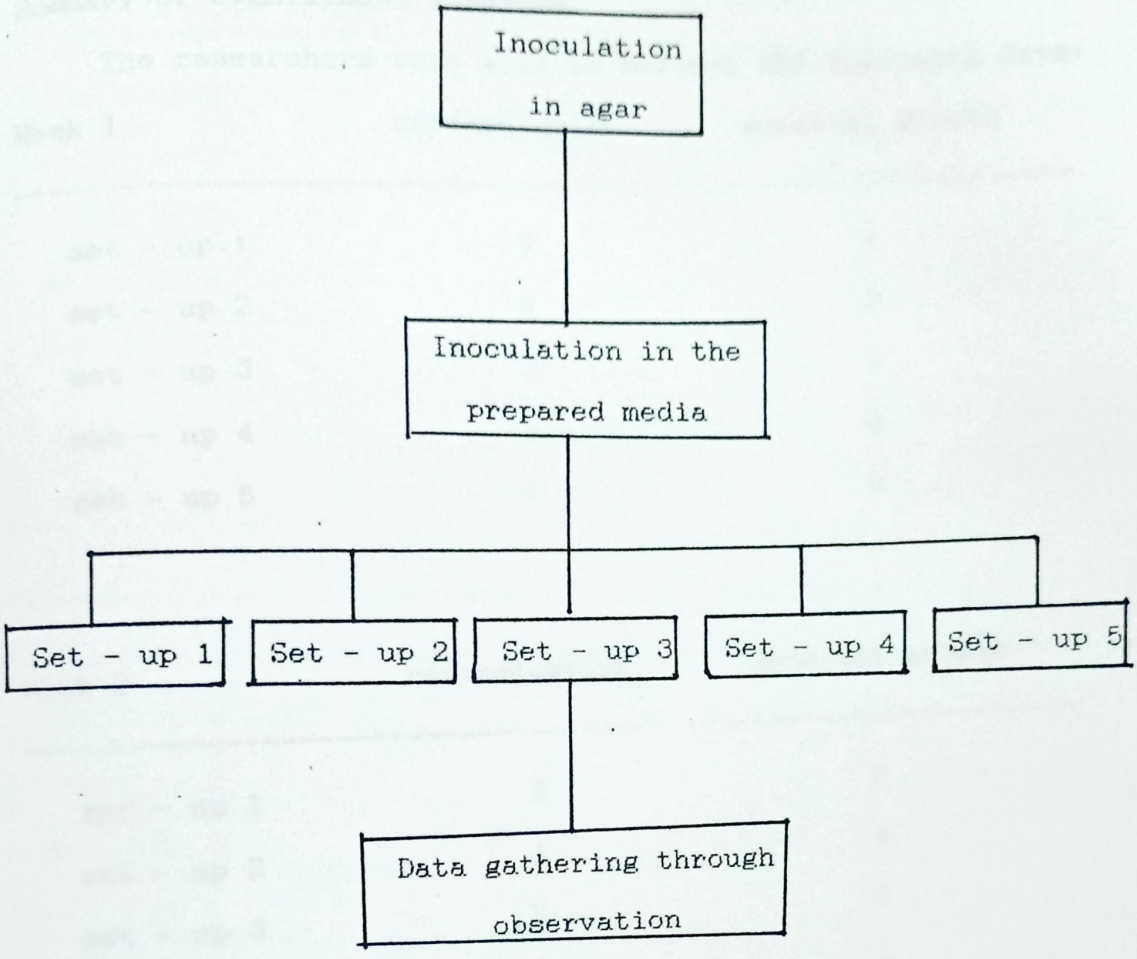
3.) The controlled set-up

Since the concentration 80% sawdust, 18% rice bran, 1% lime, 1% sugar was the conventional proportion, that concentration was used as the controlled set-up in which the differences in mycelial growth were based.

4.) The experimental set-up

The researchers provided plastics, about 12" long and 5" in diameter. The moist experimental media were placed inside the plastics and were sealed. After the preparations, the experimental set-ups were sterilized for 15 - 20 minutes at 15 psi. The spawn were then planted in the media, through inoculation in a sterile inoculation box, and then the researchers waited for the mycelium to appear on the upper portion of the bags.

Paradigm


Inoculation in agar
Inoculation in the prepared media
Set - up 1
Set - up 2
Set - up 3
Set - up 4
Set - up 5
Data gathering through observation

CHAPTER 4

Summary of Significant Findings

The researchers were able to collect the following data:

Week 1	contamination	mycelial growth
set - up 1	2	4
set - up 2	1	2
set - up 3	3	1
set - up 4	4	3
set - up 5	5	5

Week 2	contamination	mycelial growth
set - up 1	3	3
set - up 2	1	4
set - up 3	2	2
set - up 4	4	1
set - up 5	5	5

* based on the greatest (1) to the lowest (5) amoun of mycelial growth and contamination as observed.

Week 3	contamination	mycelial growth
set - up 1	2	3
set - up 2	1	4
set - up 3	3	2
set - up 4	4	1
set - up 5	5	5

Week 4	contamination	mycelial growth
set - up 1	2	3
set - up 2	1	4
set - up 3	3	2
set - up 4	4	1
set - up 5	5	5

* based on the greatest (1) to the lowest (5) amount of mycelial growth and contamination as observed.

DISCUSSION

In Week 1, the set-up that yielded the greatest amount of mycelial growth was set-up 3. The greatest amount of contamination occurred in set-up 2. Set-up 2 indicated the second greatest amount of mycelial growth, followed by 4, followed by 1, and followed by 5. Set-up 5 yielded neither mycelial growth nor occurrence of contamination.

In Week 2, the set-up that yielded the greatest amount of mycelial growth was set-up 4. The greatest amount of contamination occurred in set-up 2. Set-up 3 indicated the second greatest amount of mycelial growth, followed by 1, followed by 2, and followed by 5. Set-up 5 yielded neither mycelial growth nor occurrence of contamination.

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Conclusion

As what to what have been observed, set-up 4, which was composed of 50% sawdust, 42% rice bran, 4% lime, 4% sugar, proved to be the best concentration of the set-up for the mycelial growth of *Pleurotus sp.* It yielded greater amount of mycelial growth and lesser occurrence of contamination compared to the conventional one, the set-up 1.

Pleurotus sp. needs Nitrogen, Phosporus, and Potassium for its growth. Sawdust contains Potassium.

Set-up 4, compared to set-up 5, yielded a greater amount of mycelia. An assumption was made based on the fact that set-up 5 contained a greater amount of rice bran. Rice bran contains a substance called **lignin** which hinders the multiplication of bacteria and fungi (Mr. Eduardo Ongcol. 1997.) Since set-up 5 contained more rice bran, therefore it has more lignin, thus preventing *Pleurotus sp.* to grow and multiply.

Recommendations / Suggestions

The researchers recommend further and more intensive stud on the use of different concentartions of rice bran, sawdust lime, and sugar as substrates for the mycelial growth of *Pleuro tus sp.*

Also, the researchers suggest that the number of replicate should be increased to obtain a more convincing data.

Chapter V

Literature Cited

Reyes, Renato G. & Abella, Evaristo A. 1993. "Efficient Utilization of Agro-Industrial Wastes through Mushroom Production in the Central Luzon Region, Philippines." Philippine Technology Journal 18(3): pp. 15 - 20.

Industrial Technology Development Institute. 1993. Mushroom Technology. pp. 2 - 13.