Comparison of Soil Quality Affecting the Growth of Different Mushrooms Species in Thung Khai Botanic Garden , Trang Province

Miss. Nantikan Kanghae

Miss. Tatiya Saekhao

Miss. Kittiya Padlom

Wichienmatu School Trang , Thailand

Advisor

Ms. Kwanjai Kanjanasrimek

Abstract

Title of the research : Comparison of Soil Quality Affecting the Growth of Different Mushrooms Species in Thung Khai Botanic Garden , Trang Province

Researchers : Miss. Nantikan Kanghae

Miss. Tatiya Saekhao

Miss. Kittiya Padlom

Grade Level : Grade 11

Advisor : Ms. Kwanjai Kanjanasrimek

School : Wichienmatu School

This study investigates the effect of soil quality on the growth of different mushroom species in Thung Khai Botanic Garden, Trang Province. The objective of this research is to examine the soil quality parameters influencing the growth of various mushrooms, specifically termite mushrooms, Jun mushrooms, and egg mushrooms.The study focuses on the physical and chemical properties of the soil, including soil structure, color, texture, cohesion, pH levels, soil moisture content, temperature, and the presence of essential nutrients (Nitrogen (N), Phosphorus (P), and Potassium (K)). The findings indicate that the soil in Thung Khai Botanic Garden has an average pH ranging from 6 to 7, a moisture content of 10–20%, and a temperature range of 24–26°C. The nitrogen level averages at 2.1, phosphorus at 2.6, and potassium at 7.4

Keywords: Soil quality, soil fertility, pH value

Introduction

Mushrooms (scientific name: Mushroom) are fungi classified in the Kingdom Fungi, belonging to the phyla Ascomycota and Basidiomycota. They come in various shapes and sizes, such as umbrella-shaped, cylindrical, finger-like, or flat, growing on the ground, decaying leaves, or trees in humid environments, particularly during the rainy season. Mushrooms have a close relationship with plants, serving as both a food source and a symbiotic organism. They are divided into two main categories: 1. Edible mushrooms, such as straw mushrooms (Volvariella volvacea), shiitake mushrooms (Lentinula edodes), and others with varying flavors and aromas. Some have distinctive smells, like bamboo pith mushrooms (Phallus indusiatus), while others are bitter (Tricholoma saponaceum) or spicy (Lentinus sajor-caju). 2. Poisonous mushrooms, also known as toadstools, include species like Amanita phalloides, which can be fatal. Mushrooms are commonly found in natural forests, particularly during the rainy season. In Thung Khai Botanic Garden, both edible and poisonous mushrooms are found growing on soil, grasslands, logs, decaying wood, compost piles, animal manure, and dead plants. Since soil is a crucial factor in mushroom growth, this study aims to compare the soil quality affecting different mushroom species in the garden.

Research Objectives

1. To compare soil quality factors affecting the growth of different mushroom species.

Research Question

1. Does soil quality affect the growth of different mushroom species?

Research Hypothesis

1. Soil quality influences the growth of different mushroom species.

Variables Independent : Variable: Soil in areas where different mushroom species grow.

Dependent Variable : Soil quality.

Controlled Variables : Study location Thung Khai Botanic Garden, Trang Province, research equipment, and tools.

Materials and Equipment

1. Distilled water
2. Droppers
3. Thermometer
4. pH test paper
5. Soil moisture meter
6. Soil fertility test kit
7. Soil structure classification guide
8. Soil cohesion classification guide
9. Soil texture classification guide
10. Camera Notebook
11. writing materials

Study Location

Thung Khai Botanic Garden, Trang Province Coordinates: Latitude 7.46924, Longitude 99.64021

Research Procedures

Step 1 Soil Examination

1) Physical Soil Analysis

1.1 Soil Structure

1. Collect soil samples from different study areas, recording basic environmental data.
2. Observe the undisturbed soil sample in hand, noting its structure.
3. Measure and record soil structure characteristics. Conduct sampling once per study site.

1.2 Soil Color

1. Take a soil sample from each layer, observing its moisture condition.

2.Break the sample into two parts.

3. Hold it against a soil color chart under sunlight. Record the soil color.

1.3 Soil Cohesion

1. Moisten dry soil samples.

2. Hold a soil particle between the thumb and index finger, squeezing it to observe how it breaks apart.

3. Record the cohesion type.

1.4 Soil Texture

1. Sieve the soil to remove plant and animal debris.

2. Mix soil with water and knead until it becomes sticky.

3. Analyze texture using a soil texture classification chart.

2) Chemical Soil Analysis

2.1 pH Measurement

1. Weigh 20g of dry, sieved soil and place it in a beaker.

2. Add an equal amount of distilled water.

3. Stir for 30 seconds, let settle for 3 minutes, repeating 5 times.

4. Dip a pH strip or meter into the clear liquid and record the pH value.

2.2 Nutrient Content (N, P, K)

1. Weigh 20g of dry soil

2. Mix with 100ml of distilled water stir well and let settle.

3. Use a soil nutrient tester to measure nitrogen, phosphorus, and potassium levels

2.3 Soil Temperature

1. Pour approximately 250 milliliters of water at room temperature into a beaker (ensure the water level in the beaker is higher than 4 centimeters to allow the sensor of the soil thermometer to submerge during calibration).
2. Immerse both the standard thermometer and the soil thermometer into the water.
3. Wait for 2 minutes.
4. Read the temperature from both the standard thermometer and the soil thermometer. If the difference between the readings is less than 2°C, the thermometer is calibrated.
5. If the temperature readings differ by more than 2°C, wait for another 2 minutes.

6. If the temperature readings still differ by more than 2°C, adjust the screw at the bottom of the soil thermometer using a wrench until the temperature readings from both thermometers are close to each other.

2.4 Soil Moisture Measurement

1. Collect soil samples at depths of 0-5 cm, 10 cm, 30 cm, 60 cm, and 90 cm, with at least 3 samples from each depth.

2. Label the soil samples with their corresponding details.

3. Weigh the soil samples before drying.

4. Dry the soil samples at a temperature of 95-105°C for 24 hours. 5. Weigh each soil sample after drying and calculate the moisture content.

Results

Table 1: Physical Properties of Soil

Thung Khai Botanic Garden	Physical properties of soil			
	Soil structure	Soil color	Soil texture	Soil cohesion
Termite fungus	Granular	7.5YR 3/3	Sandy loam	Firm
Jun mushroom	Granular	7.5YR 2.5/2	Sandy clay loam	Friable
Egg mushroom	Granular	7.5YR 2.5/1	Loamy sand	Firm

From Table 1, it can be observed that all three mushroom species grow in soil with different physical characteristics. All three types of soil exhibit a granular structure. The soil color varies: the termite fungus grows in light brown soil, the jun mushroom in reddish brown soil, and the egg mushroom in dark brown soil. The soil texture also differs, with termite fungus found in sandy loam, jun mushroom in sandy clay loam, and egg mushroom in loamy sand. Soil cohesion also varies: the termite fungus and egg mushroom grow in firm soil, whereas the jun mushroom grows in friable soil. These physical properties of soil affect the growth and suitability of each mushroom species.

Table 2 : Soil Temperature

Thung Khai Botanic Garden	Soil Temperature (℃)			
	Trial 1	Trial 2	Trial 3	Average
Termite fungus	24	23	25	24
Jun mushroom	24	25	24	24
Egg mushroom	26	26	26	26

From Table 2, it can be seen that the soil temperature differs among the three species. The average soil temperature for termite fungus and jun mushroom is 24°C, while the soil temperature for egg mushroom is 26°C. Soil temperature significantly impacts mushroom growth since each species has an optimal temperature for its development. If the temperature deviates too much from this optimal range, the mushrooms may not grow properly.

Table 3 : Soil Moisture

Thung Khai Botanic Garden	Soil Moisture			
	Trial 1	Trial 2	Trial 3	Average
Termite fungus	10	10	10	10
Jun mushroom	20	20	20	20
Egg mushroom	10	10	10	10

From Table 3, it is evident that the three mushroom species grow in soils with different moisture levels. The average soil moisture for termite fungus and egg mushroom is 10%, whereas for jun mushroom, it is 20%. Soil moisture influences mushroom growth because mushrooms require a suitable moisture level to thrive. If the soil is too dry, mushroom growth may be stunted.

Table 4 : pH Levels

Thung Khai Botanic Garden	pH values			
	Trial 1	Trial 2	Trial 3	Average
Termite fungus	6.0	7.0	6.0	6.3
Jun mushroom	6.0	6.0	6.0	6.0
Egg mushroom	7.0	7.0	7.0	7.0

From Table 4, it is shown that the soil pH varies among the three mushroom species. The termite fungus grows in soil with an average pH of 6.3, the jun mushroom in soil with an average pH of 6.0, and the egg mushroom in soil with an average pH of 7.0. Soil pH affects mushroom growth because it influences the decomposition of organic matter and nutrient availability in the soil. If the pH is too acidic or too alkaline, it may create unfavorable conditions for mushroom development.

Table 5: Mineral Content in Soil

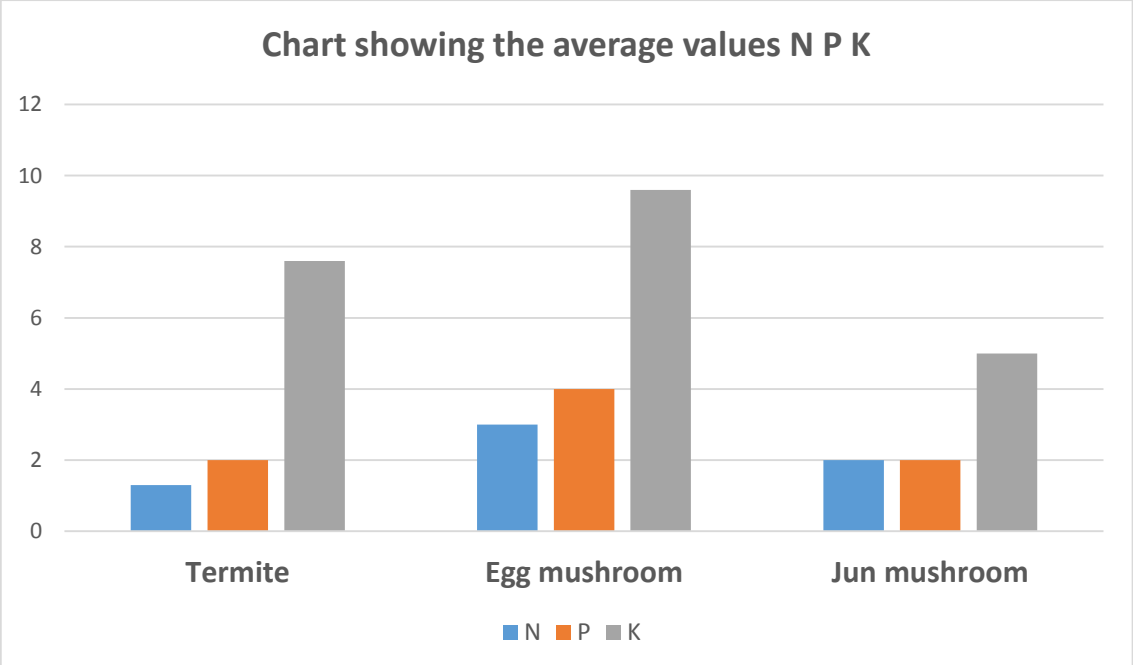

Table 5 shows the mineral content in the soil for the three types of mushrooms, where termite fungus soil contains 1.3% nitrogen (N) , 2.0% phosphorus (P), and 7.6% potassium (K), jun mushroom soil contains 2.0% nitrogen (N), 2.0% phosphorus (P), and 5.0% potassium (K), and egg mushroom soil contains 3.0% nitrogen (N) , 4.0% phosphorus (P), and 9.6% potassium (K), with an overall observation that potassium (K) levels are consistently higher than nitrogen (N) and phosphorus (P) in all soil samples, which may influence the growth and development of the mushrooms.

Conclusion and Discussion

The study on soil quality affecting the growth of different mushroom species at Thung Khai Botanic Garden, Trang Province, found that soil quality factors, including pH, moisture, temperature, and essential mineral content (nitrogen (N) , phosphorus (P), and potassium (K)), significantly influence mushroom growth. The optimal soil pH for mushroom growth ranges between 6 and 7, which promotes healthy development. Soil moisture affects certain mushroom species, such as Jun mushroom, which requires higher moisture levels than other species. The ideal soil temperature for mushroom growth is between 24-26°C, with Egg mushroom thriving best at slightly higher temperatures compared to other mushrooms. Regarding mineral content, potassium (K) levels were found to be higher than other nutrients in the studied soils, playing a crucial role in the growth of all mushroom species. Egg mushroom had the highest nitrogen (N) , phosphorus (P), and potassium (K) levels, leading to optimal growth, while Termite fungus thrived in soil with high potassium but low nitrogen levels. Jun mushroom had moderate nutrient levels and required high moisture for proper growth. These findings highlight the importance of soil properties in optimizing mushroom cultivation and suggest that different mushrooms have specific soil requirements for optimal growth.

Acknowledgements

The research project, “Comparison of Soil Quality Affecting the Growth of Different Mushroom Species,” has been successfully completed thanks to the support and encouragement of many individuals. We would like to express our deepest gratitude to Mr. Sakda Paisomboon, Director of Wichienmatu School, for his support and encouragement throughout this research.

Our sincere appreciation goes to Ms. Khwanchai Kanjanasrimek, our research advisor, for her invaluable guidance, advice, and assistance in reviewing and correcting various aspects of this study. Her dedication and expertise have been instrumental in the successful completion of this project.

We would also like to extend our heartfelt thanks to our friends for their support, constructive feedback, and willingness to exchange ideas throughout the research process. Their collaboration and encouragement have contributed significantly to the success of this study. Lastly, we are grateful to everyone who has contributed, directly or indirectly, to the completion of this research.

Researchers

Ms. Nantikan Kanghae

Ms. Tatiya Saekhao

Ms. Kittiya Padlom

Reference documents

Pattharavee Phornmanat, Winai Somprasong, and Mongkol Thammasakorndej. "Species Diversity of Edible Mushrooms at Maesa Research Forest Station, Hot District, Chiang Mai Province." Kaen Kaset, Special Issue 42: 2 (2024).

Suchitra Kosol, Sunaree Wangluek, Thanaphak Inyod, Thanapat Temarom, Wana Mungkit, and Thanakorn Lattitheerasuwan. "Species Diversity and Ecology of Edible Wild Mushrooms in the Community Forest Area of Baan Bunjam, Phrae Province." (Revised Version: March 15, 2019).

Mushrooms from Forest Areas in Nature. https://www.tistr.or.th/tistrblog/wpcontent/uploads/2018/01/mushroomTISTR.pdf

Documents and Research Related to Mushrooms at Chiang Mai Rajabhat University. http://cmruir.cmru.ac.th/bitstream/123456789/1265/5/5.Chapter-2.pdf

Types and Species of Mushrooms. Rakbankerd. Link to source. https://www.rakbankerd.com/agriculture/print.php?id=1278&s=tblplant