The Diversity of Macroscopic Mushroom at Muhammad Sabki City Forest Park in Jambi City

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Abstract. The diversity of Indonesia’s flora is shown by the richness of its tropical forests. One of the biodiversities is mushroom of which type is estimated to be 200,000. The aim of the study is to distinguish the diversity of macroscopic mushroom at the forest city park of Muhammad Sabki, Jambi City. This is a descriptive exploratory research by applying a sampling technique through exploring the founded mushrooms and laid the plots randomly. The data are collected by observing, making herbariums, documenting, and identifying the samples. The finding shows that there are 13 species of mushrooms from 2 divisions and 8 families. Basidiomycota division consists of 7 families namely Ganodermataceae, Agaricaceae, Polyporaceae, Dacrymycetaceae, Auriculariaceae, Tremellaceae, and Maramiaseaceae. Whereas, the Ascomycota division has 1 family called Xylariaceae. The types of mushroom founds are Ganoderma applanatum (Pers.) Pat, Ganoderma sp., Paxillus sp, Pycnoporus sp, Lentinus strigosus Fr., Lentinus sajor-caju, (Fr.) Fr., Tyromyces chionaeus (P.) P.Karst, Dacryopinax spathularia (Schwein.) GW.Martin, Auricularia auricular (Fr.) J.Schrot., Tremella fuciformis Berkeley, Marasmius candidus (Bolt.) Fr., Marasmius glabellus Peck., Daldinia concentrica (Bolton) Cæsati & de Notaris. The diversity index figure at the research setting is said to be moderate with an index number of 2.63.

1. Introduction
The diversity of Indonesia’s flora is shown by the richness of its tropical forests, ranging from the lowlands to the highlands covering 63% of the mainland of Indonesia. One of the biodiversities is mushroom. The forests are the habitations of various plants such as vines, bushes, trees of various sizes, and other organisms like algae, moss, and mushroom [1].

There are about 200,000 types of mushroom in Indonesia, but there is no definite report on the number of mushroom that have been indentified, used and extinct [2]. On the other hand, we are faced with the rapid rate of biodiversity decline as a result of human’s doings or natural processes. If this continues, many unidentified macroscopic mushrooms will extinct in the future. It will be a big loss because mushrooms play the role of decomposers in ecosystem, decomposing or breaking down dead organic matters from animals and plants [3].

For example, the City Forest Park of Muhammad Sabki. It is one of areas dominated by lowland and highland plants including mushrooms. Based on the interview with the park manager, there was no study on the park mushroom in the past, so the researcher was interested to study and explore the existence and the diversity of mushrooms at the city Forest Park of Muhammad Sabki.
2. Materials and Methods

2.1. Time and Setting
The research took place at the city forest park of Muhammad Sabki in Jambi City. The forest is located in administrative area of sub-district Kenali Asam Bawah and bordering with sub-district Mayang Mangurai in district Kota Baru, Jambi City. Geographically, the forest is located on the East Longitude of 03°34’52’’ - 103°34’11’’ and South Latitude of 01°39’08’’-01°39’22’’. This 10 acre forest area was decided according to Jambi Mayor's decree number 607 year 1995 on the 12th of December 1995. In 2003 an acre was added to the forest area, so the total area is 11 acres. The research was conducted for a month from March to April 2020 with a sample of 10% area or about 1 acre at medium use zone. The research was then continued to sample identification process at Class I Agricultural Quarantine Centre of Jambi Province.

2.2. Tools and Materials
Tools and materials used were GPS (Global Positioning System), a camera, pruning shears, a knife, stationary, a tape measure, plastic rope, sample bottles, containers, old newspapers, tags, and alcohol 70%.

2.3. Data Collection Method
The research was performed in two stages, namely observation and data collection. The data collection was direct data collection from the field, herbarium, documentation and sample identification.

2.4. Research Procedure
The research employed random sampling method for choosing the sampling location so the entire population has same opportunity to be chosen as sample. Plots were placed randomly on about 10% of total forest area (± 1 acre or 10,000 m2) at medium use zone. The placement of sub-plots were done randomly by using plastic rope and a tape measure, with the measurement of 1 x 1m2. The researcher then chose the samples and took notes their information including local name, species, habitat, morphological features such as size, shape, color, basidiocarp and other characteristics like growing substrate and life form. The samples were labelled with numbers. Macroscopic mushrooms were photographed and moved to sample containers filled with alcohol 70%. The preserved samples were then taken to Class I Agricultural Quarantine Centre of Jambi Province for further research.

2.5. Data Analysis
The abundance of macroscopic mushrooms in the forest park Muhammad Dabki can be known by using the analysis of importance value index parameter (INP). The vegetation analysis was done by calculating Density (D), Relative Desity (DR), Frequency (F), Relative Frequency (FR), and Shannon-Wiener Diversity Value Index (H').

Shannon-Wiener Diversity Value Index

\[ H' = \sum_i p_i \ln p_i \]

Notes: 
H' = Shannon-Wiener Diversity Index
p_i = Numbers of individuals of a mushroom type.
n_i = Numbers of individuals of all mushroom types
N = Total numbers of individuals

Simpson Index

\[ 1-D = 1 - \sum (P_i)^2 \]

Notes: 
1-D : Simpson Diversity Index
P_i = n_i/N: Individual proportion type (number)
n_i : numbers of individuals of a species (number)
N : total numbers of individuals of all species
3. Results and Discussion

3.1. Research Findings

The research at the medium use zone of city forest park Muhammad Sabki in Jambi City found 13 macroscopic mushroom species with a total number of 143 individuals classified into two divisions and 8 families.

Table 1. Types of mushrooms found in the city forest park Muhammad Sabki in Jambi City

| No | Division       | Family            | Species                      | Numbers of individuals |
|----|----------------|-------------------|------------------------------|------------------------|
| 1. | Basidiomycota  | Ganodermataceae   | Ganoderma applanatum Pat     | 4                      |
| 2. | Basidiomycota  | Polyporaceae      | Pycnoporus sp                | 2                      |
| 3. | Basidiomycota  | Agaricaceae       | Paxillus sp                  | 8                      |
| 4. | Basidiomycota  | Polyporaceae      | Lentinus sajor-caju Fr       | 7                      |
| 5. | Basidiomycota  | Polyporaceae      | Lentinus strigosus Fr        | 4                      |
| 6. | Basidiomycota  | Polyporaceae      | Tyromyces chionae P. Karst   | 12                     |
| 7. | Basidiomycota  | Polyporaceae      | Dacryopinax spathularia G. W. Martin | 23                    |
| 8. | Basidiomycota  | Auriculariaceae   | Auricularia auricula Underw  | 10                     |
| 9. | Basidiomycota  | Tremellaceae      | Tremella faciformis Berk     | 5                      |
| 10.| Basidiomycota  | Maramiaseace      | Marmius candidas Fr          | 5                      |
| 11.| Basidiomycota  | Maramiaseace      | Marasmius glabellus Peck     | 30                     |
| 12.| Basidiomycota  | Xylariaceae       | Daldina consentrica Fr       | 6                      |

| Total numbers of individuals | 143 |

Table 1 shows that macroscopic mushrooms found in the city forest park are classified into two divisions, namely Basidiomycota and Ascomycota. This finding is in line with Ganjar [5] stating that the majority of macroscopic mushrooms in tropical forests belong to Basidiomycota division and few of them belong to Ascomycota division. Of Basidiomycota division, the researcher identified 12 species, 2 species of Ganodermataceae family, 1 species of Agaricaceae, 4 species of Polyporaceae, 1 species of Dacrymycetaceae, 1 species of Auriculariaceae, 1 species of Tremellaceae, 2 species of Maramiaseae species. The researcher also found 1 species of Xylariaceae from Ascomycota division in the field.

The findings revealed that the macroscopic mushrooms in the location were dominated by Basidiomycota division and only one species of Ascomycota, that is Daldina Consentrica, found in the location.

Table 2. Mushroom habitat found in the city forest park Muhammad Sabki in Jambi City

| No | Types                     | Dead Tree | Living Tree | Leaf Litter |
|----|---------------------------|-----------|-------------|-------------|
| 1  | Ganoderma applanatum Pat. | -         | +           | -           |
| 2  | Ganoderma sp.             | +         | -           | -           |
| 3  | Paxillus sp.              | +         | -           | -           |
| 4  | Pycnoporus sp.            | +         | -           | -           |
| 5  | Lentinus strigosus Fr.    | +         | -           | -           |
| 6  | Lentinus sajor-caju Fr.   | +         | -           | -           |
Tyromyces chioneus P. Karst + - -
Dacryopinax spathularia G.W. Martin + - -
Auricularia auricular Underw + - -
Tremella fuciformis Berk + - -
Maramius candidus Fr. - + -
Marasmius glabellus Peck - - +
Daldina consentrica Fr. + - -

Note: (+) found, (-) not found

Figure 1. The diagram of importance value index of mushrooms in the city forest park Muhammad Sabki Jambi City

Importance Value Index (INP) was obtained from the calculation of relative density and relative frequency. The highest INP of macroscopic mushroom species belongs to Marasmius glabellus species with value of 0.419, followed respectively by species Pycnoporus sp., Dacryopinax spathularia, Tyromyces chioneus, Auricularia auricula, Paxillus sp. and Ganoderma sp. as the lowest with INP value of 0.027.

Dominant species in a plant community usually has the highest INP value among other species. INP value also indicates the significance of a species role in a plant community. Dominant macroscopic mushroom in the location is Marasmius glabellus. This mushroom lives in leaf litters and serves as a decomposer on the forest floor. It breaks down forest litters, turning them into nutrients that are used as natural fertilizer by the forest ecosystem (table 2).

Shannon-Wiener diversity index value in the forest park Muhammad Sabki of Jambi City is 0.984. The value shows that the level of macroscopic mushroom diversity in the forest park is low.

Simpson dominance index value of macroscopic mushroom types in the location is 0.128. Simpson index value (D) is compared to Shannon-Wiener index value (H'). Based on these values it can be said that the city forest park of Muhammad Sabki has low diversity level.

3.2. Discussion
Shannon-Wiener index value (H’) of macroscopic mushroom in the city forest of Muhammad Sabki Jambi City is 0.984. According to Fachrul (2012), if H value is lower than 1 (H<1), the species biodiversity in a location is low. In other words, ecosystem condition of the forest is not balanced and
ecological stress in the forest is low. It could also be caused by other environmental factors and existing substrates in the forest. Substrate is source of nutrients used by macrofungi for its growth. Different substrates will grow different numbers and types of macroscopic mushrooms. Frischa in [8] stated that abiotic factor that affects the spread and the growth of mushrooms could be one of defining factors of low mushroom diversity in the location.

Types of mushroom in the forest park Muhammad Sabki as shown in table 1 are mainly dominated by those of basidiomycota division, because macroscopic mushrooms are usually from basidiomycota division. The most species are Marasmius glabellus from Agaricales order with the total of 30 individuals. The members of Agaricales are huge and complex. In some research, the members of this order are very easy to find and usually in a big numbers of individuals. This means that the species have good adapting ability in the ecosystem and have better spreading pattern compared to other mushrooms. The existence of macroscopic mushrooms in Muhammad Sabki forest park are inseparable from its environmental condition. Certain environment highly affects the ability of mushroom and grows certain types of mushroom. Mushroom likes living in shady area, cool, and damp like on the floor of secondary forest. Secondary forest is a good habitat for mushrooms and has temperature of 30ºC. Muhammad Sabki forest park has a temperature of 25ºC – 29ºC, and 55% - 91% humidity.

According to picture 1, mostly found mushrooms are from family Polyporaceae consisted of four types of mushrooms, namely Pycnoporus sp, Lentinus strigosus, Lentinus sajor-caju, Tyromyces chioneus. Polyporaceae has a good adapting ability compared to other families. This family has large members because it grows on dead trees. Suhardiman in [1] explained that Ordo Aphylloporales from class Basidiomycetes is a group of mushrooms with many species and commonly found because they grow on leaf litters and dead tree and are able to adapt in environment other than their habitat. The least found mushrooms are from Agaricaceae Dacrymycetaceae, Auriculariaceae, Tremellaceae, Xylariaceae, with one species of each family.

Table 2 shows that most mushrooms are found on dead tree and leaf litters and few are found on living trees. Ganjar [5] explained that most mushrooms are found on tree. They cause deterioration and rotting in wood. They have a very strong cellullotic activity. They can live both on living and dead trees. In this research, 10 types are found on dead trees. 2 types are found on the skin of living tree, and 1 type is found on leaf litters. Basidiocarp of the mushrooms indicates that they are tree mushrooms that have ecological function as saprophytes or decomposers.

The diversity of mushroom found in this location is smaller than those found in Hutan Taman Bukit Sari in Tebo Ilir District with the total of 20 types [2], Hutan Durian Luncuk II Batanghari with the total of 38 types [9], Hutan Gunung Tujuh Resort North Kerinci Taman Nasional Kerinci Seblat with the total of 30 types [11]. This is due to the difference of natural condition and temperature. Environmental condition is very important for mushroom living ability and it also determine the growth of various types of mushrooms. In addition, the growth is also affected by substrate supply in the forest.

Muhammad Sabki city is 11 acres forest park smaller than the Nature Preserve of Durian Luncuk II which has an area of 41.37 acres and Hutan Taman Bukit Sari in Tebo Ilir District which has an area of 425 acres. Muhammad Sabki city forest park is protected by the government of Jambi City. It was once an old rubber plant plantation which was then rejuvenated by the governments and now the forest has about 200 types of plants.

By observing macroscopic mushroom in a forest, we can know the function of it for the ecosystem. Macroscopic mushrooms found in the forest of Muhammad Sabki are commonly wood and litter decomposers. In other words the mushrooms serve as decomposer in the food chain of the forest ecosystem. This is in accordance to Suharna statement in [10], mushrooms play role as decomposers along with bacteria and some species of protozoa, so they help the decomposition process of organic matters and accelerate matter cycle in forest ecosystem. Munir in [10] also stated that groups of macroscopic mushrooms are main groups responsible for degrading lignocellulose because they produce degrading enzyme such as cellulose, ligninase, and hemicellulose.
4. Conclusion
From this research, it can be concluded that Muhammad Sabki forest park has low level of macroscopic mushroom diversity with the index value of 0.984. In the location, the researcher identified 13 species of mushrooms consisting of 2 divisions and 8 families. The families are Ganodermataceae, Agaricaceae, Polyporaceae, Dacrymycetaceae, Auriculariaceae, Tremellaceae, Maramiasece. Ascomycota division consisted of 1 family (Xylariaceae). Types of mushroom found in the forest are Ganoderma applanatum Pat, Ganoderma sp., Paxillus sp., Pycnoporus sp., Lentinus strigosus Fr, Lentinus sajor-caju Fr, Tyromyces chioneus P.Karst, Dacryopinax spathularia G.W. Martin, Auricularia auricula Underw, Tremella fuciformis Berk, Maramius candidus Fr, Marasmius glabellus Peck, Daldina consentrica Fr.

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