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Submission date: 27-Apr-2021 10:33AM (UTC+0800)

Submission ID: 1570946397

File name: 3_BiodiversityofEdibleMacrofungi-I.pdf (688.58K)

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Research Article

Biodiversity of Edible Macrofungi from Alas Purwo National Park

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ARTICLE INFO:

Article History:

Received: 28/01/2016
Revised: 29/03/2016
Accepted: 03/04/2016
Available Online: 04/04/2016

Keywords:

Alas Purwo National Park,
Alternative Food Sources,
Biodiversity,
Ecosystem,
Edible Macrofungi,
Nutritional Value,
Tropical Rainforest

Abstract: This research aimed to invent edible macrofungi in Alas Purwo National Park that can be used as alternative food sources. The method that was used in this research was the explorative method with descriptive analysis. The sampling process took place along the side trail of the tropical rainforest ecosystem of Alas Purwo National Park. The tropical rainforest ecosystem that was reached from Triangulasi Resort with geographics coordinates 8° 39' 20.9" S 114° 21' 39.2" E then going to northwest for around three kilometres until Sadengan Track with geographics coordinates 8° 39' 13.1" S 114° 22' 18.2" E. The other track was from Triangulasi Resort with geographics coordinates 8° 39' 20.9" S 114° 21' 39.2" E then going to east for around five kilometres until Pancur Track with geographics coordinates 8° 40' 38.91" S 114° 22' 25.90" E. The collections of macrofungi samples were limited until five metres left and five metres right of the track. The result of this research showed there were 40 different genera and 22 of them are edible. Those 22 genera are *Auricularia*, *Cantharellus*, *Clavulina*, *Collybia*, *Coltricia*, *Coprinus*, *Crepidotus*, *Dictyophora*, *Flammulina*, *Geastrum*, *Hydnellum*, *Inocybe*, *Leucocoprinus*, *Marasmius*, *Meripilus*, *Mycena*, *Oligoporus*, *Peziza*, *Pleurotus*, *Polyporus*, *Psathyrella*, and *Tremella*.

INTRODUCTION

Indonesia is a tropical country with very high biodiversity rate, including the diversity of macrofungi. There are approximately 80,000 species of fungi in Indonesia considering the humidity and tropical temperature that are supporting the growth of fungi [1]. Macrofungi is one of the biological resource, which play important roles in human life.

Alas Purwo National Park is one of the national parks located in East Java, Indonesia (Figure 1). Historically, this area was established as a nature monument in 1913 and declared as a national park in 1992. This is a 42,000 ha lowland forest that is the best-known habitat for the spectacular wildlife in Java [2]. Alas Purwo National Park is one of representative tropical rain forest in eastern java which has natural condition supporting biodiversity of macrofungi because of its humidity and high rain precipitation. Ansori *et al.* (2014) found 17 genera of edible macrofungi from Meru Betiri National Park [3]. On the other hand, there are not data about biodiversity of edible macrofungi from Alas Purwo National Park.

The potential of macrofungi in general is its function as decomposer, but some macrofungi are edible and therefore potential for a food source [4]. Some macrofungi are edible because it has fruit body, not poisonous, and has nutritional value [5]. Edible macrofungi has high protein with complete

amino acid including the essential amino acid which human needs and also contains vitamin B complex [4, 6, 7, 8] and some mineral salt from the elements of Ca, P, Fe, Na, and K [4, 9, 10, 11]. Biodiversity and potential of macrofungi in Indonesia is still has not known much. The inventory of edible macrofungi from Alas Purwo National Park aims to make records of macrofungi, which can be utilized, as alternative food sources.

MATERIALS AND METHODS

This research is done for two days, started from February 18th-19th 2015 in Alas Purwo National Park. The selected location for macrofungi sampling is alongside the trail of the tropical rainforest ecosystem of Alas Purwo National Park. The area in the first day reached from Triangulasi Resort with geographic coordinates 8° 39' 20.9" S 114° 21' 39.2" E then going to northwest for around three kilometres until Sadengan Track with geographics coordinates 8° 39' 13.1" S 114° 22' 18.2" E. In the second day the track was from Triangulasi Resort with geographics coordinates 8° 39' 20.9" S 114° 21' 39.2" E then going to east for around five kilometres until Pancur Track with geographics coordinates 8° 40' 38.91" S 114° 22' 25.90" E. The collecting of macrofungi samples was limited until five metres left and five metres right of the track.

The instruments used in this research are digital camera, knife, cutter, scoop, labels, plastic bags, stationery, calipers,

determination and characteristic sheets, latex gloves, soil tester, magnifying glass, *The Complete Encyclopedia of Mushrooms* [5], and *The Great Encyclopedia of Mushrooms* [12] to facilitate observation and identification. The materials used for identification is all the macrofungi that found in Alas Purwo National Park.



Figure 1. Eastern Part of Java, APNP is Alas Purwo National Park [2]

Samples were photographed with standard comparator such as ruler and calipers. The environmental parameters where the sample grows were also noted, for example substrates (trees, decomposed woods, and soil), soil pH, and substrate temperature. The samples were collected by knife or cutter for macrofungi living in a decomposed tree, whereas for macrofungi living on the decomposed remains above soil is collected using scoop. After the sample is collected, it is placed in a labeled plastic bag.

The collected macrofungi were classified by its fruit body such as cup fungi, puffball fungi, stick fungi, jelly fungi, bracket fungi, and coral fungi. Then, further identification with the character of each macrofungi and type of growth substrates was conducted to determine its genus. The macrofungi edibility potential is known by referring to *The Complete Encyclopedia of Mushrooms* [5] and *The Great Encyclopedia of Mushrooms* [12].

RESULTS AND DISCUSSION

The inventory of edible macrofungi from the tropical rainforest ecosystem of Alas Purwo National Park found 40 genera and 16 unidentified isolates because of the characters were not matching to the references. From 40 genera, 22 genera were identified into edible macrofungi (Table 1). Edible macrofungi has fruit body, not poisonous, and has nutritional value [5]. From the tropical rainforest ecosystem of Alas Purwo National Park, the edible macrofungi were found are *Auricularia*, *Cantharellus*, *Clavulina*, *Collybia*, *Coltricia*, *Coprinus*, *Crepidotus*, *Dictyophora*, *Flammulina*, *Gaeastrum*, *Hydnellum*, *Inocybe*, *Leucocoprinus*, *Marasmius*, *Meripilus*, *Mycena*, *Oligoporus*, *Peziza*, *Pleurotus*, *Polyporus*, *Psathyrella*, and *Tremella*.

Generally, macrofungi contain 90% water and 10% dry matter. Protein content varies between 27% and 48%, carbohydrates are less than 60% [13], and low-fat [4, 8, 14] only consisting of 2-8% of the dry weight [4, 13]. High protein contents are ideal as a food source for it contains every essential amino acid the body needs [4]. Macrofungi contain all nine amino acids essential for human and they are especially rich in lysine and leucine, which are lacking in most staple cereal foods [15]. Furthermore, it is known that the protein content of macrofungi is about twice that of vegetables and four times that of oranges [16].

Table 1. List of macrofungi genera from the tropical rainforest ecosystem of Alas Purwo National Park

Genera	Edible Macrofungi	Genera	Edible Macrofungi
<i>Xylaria</i>	×	<i>Coprinus</i>	✓
<i>Trametes</i>	×	<i>Polyporus</i>	✓
<i>Thelephora</i>	×	<i>Lenzites</i>	×
<i>Peziza</i>	✓	<i>Mycena</i>	✓
<i>Corioloopsis</i>	×	<i>Phylloporus</i>	×
<i>Phaeolus</i>	×	<i>Collybia</i>	✓
<i>Ganoderma</i>	×	<i>Psathyrella</i>	✓
<i>Meripilus</i>	✓	<i>Dictyophora</i>	✓
<i>Tremella</i>	✓	<i>Clitocybe</i>	×
<i>Gaeastrum</i>	✓	<i>Coltricia</i>	✓
<i>Leucocoprinus</i>	✓	<i>Pleurotus</i>	✓
<i>Hydnellum</i>	✓	<i>Xerula</i>	×
<i>Inocybe</i>	✓	<i>Marasmius</i>	✓
<i>Flammulina</i>	✓	<i>Clavulina</i>	✓
<i>Omphalina</i>	×	<i>Stereum</i>	×
<i>Crepidotus</i>	✓	<i>Cantharellus</i>	✓
<i>Calocybe</i>	×	<i>Lactarius</i>	×
<i>Cudoniella</i>	×	<i>Pycnoporus</i>	×
<i>Auricularia</i>	✓	<i>Hygrophorus</i>	×
<i>Oligoporus</i>	✓	<i>Amanita</i>	×

The fruit body of edible macrofungi is a great source of vitamin B complex [4, 6, 7, 8]. Vitamin B complex consists of riboflavin (B2), niacin (B3), thiamine (B1), biotin, folic acid, and vitamin B12. One hundred grams of fresh macrofungi gives more than 25% vitamins needed by an adult per day. Macrofungi is unique because it contains vitamin B12 which not every vegetable has. In each gram of macrofungi contain 0.32 to 0.65 mg vitamin B12. Niacin is essential for forming enzymes needed to transform sugar into energy, also maintaining body tissues to keep healthy. Riboflavin is needed to process nutrients such as vitamin B6, niacin, and folic acid to a simpler form which can be utilized by the body [4]. The Figure 2 shows a kind of edible macrofungi from Alas

Purwo National Park, *Dictyophora indusiata* or bamboo fungus.

Macrofungi cultivation in Indonesia is relatively advanced compared to other countries such as China, Japan, Taiwan, France, Italy, United States, and others [17]. Currently, around 30 species of edible macrofungi cultivated commercially and only 15 species are produced on an industrial scale [18]. In Indonesia, there are some species of macrofungi that have been known and cultivated, such as *Volvariella*, *Agaricus*, *Pleurotus*, *Auricularia*, *Lentinus*, *Flammulina*, *Velutives*, and *Grifola* [17]. From the tropical rainforest ecosystem of Alas Purwo National Park, it is found that 22 genera have potential for a food source. This fact increased the information about diversity of edible macrofungi which can be cultivated as alternative food sources.



Figure 2. An edible macrofungi from Alas Purwo National Park, *Dictyophora indusiata* or bamboo fungus

CONCLUSION

Genera of edible macrofungi from the tropical rainforest ecosystem of Alas Purwo National Park are *Auricularia*, *Cantharellus*, *Clavulina*, *Collybia*, *Coltricia*, *Coprinus*, *Crepidotus*, *Dictyophora*, *Flammulina*, *Gastrum*, *Hydnellum*, *Inocybe*, *Leucocoprinus*, *Marasmius*, *Meripilus*, *Mycena*, *Oligoporus*, *Peziza*, *Pleurotus*, *Polyporus*, *Psathyrella*, and *Tremella*. Furthermore, this result should be a reference for further exploration and increased the information about diversity of edible macrofungi in Alas Purwo National Park as alternative food sources.

ACKNOWLEDGEMENTS

Special thanks to Alas Purwo National Park for giving facilities and permission to do this research, Himpunan

Mahasiswa Biologi (HIMBIO) Universitas Airlangga which held P3L 2015 at Alas Purwo National Park, also Microbiology Study Club HIMBIO Universitas Airlangga which formed Mushroom Research Group for P3L 2015 at Alas Purwo National Park.

COMPETING INTERESTS: The author has declared that no competing interests exist.

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