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Research Article

Identification of Edible Macrofungi at Kerandangan Protected Forest & Natural Park, West Lombok Regency, Indonesia

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Abstract

Indonesia is considered as a mega-biodiversity country that has a massive amount of vascular and non-vascular plants. The tropical environment condition of Indonesia could support the growth of macrofungi. Information about edible macrofungi from the Forest of Lombok Island is based on limited data. This research aims to characterize the edible macrofungi at Kerandangan Protected Forest & Natural Park, West Lombok Regency, Indonesia. This research was a descriptive and explorative study. The edible mushrooms were observed through the Cruise method by following the particular track inside the forest. The sample found in the forest then documented and evaluated. A morphological analysis procedure was performed to assess the profile and similarity between the microscopic evaluations with the mushroom's identification book. In this study, we also offered a phylogeny analysis based on morphological characters similarity. The Dendrogram tree was reconstructed using PAST 3.0. software. The result showed that there are eight species of edible mushrooms found that were group into Basidiomycota, namely, *Termitomyces clypeatus, Termitomyces umkowaan, Termitomyces sp.1, Pleorotus flabelatus, Pleurotus ostreatus, Coprinus desimenatus, Tremella fuciformis, and Polyporus sp.* All of them involved in Basidiomycota. Based on characterization and identification, the species are grouped into three the Ordos and five Families. Most of the edible macrofungi found at Kerandangan Protected Forest & Natural Park growth at soil and deadwood.

Keywords: Edible fungi, Kerandangan Forest, Lombok, macrofungi.

1. Introduction

Lombok Island is part of the East Indonesia area, which has excellent natural attractions (Firdausi et al., 2017). The eastern region is affected by a transitional zone of Asia and the Australia continent called Wallace line. The area of the Wallace line is well known as the resource of biodiversity (Patoka et al., 2016). Lombok Island is located at the Lesser Sunda archipelago, which has a lowland rainforest (Jones et al., 2019; Royce et al., 2018). Kerandangan Protected Forest & Natural Park is one conservation forest in West Lombok Regency. This forest has an ideal condition for macrofungi habitat. Based on Schmidt-Ferguson theory, Kerandangan Protected Forest & Natural Park has a climate with D type, and the rainfall is about 125.2 mm per month (Balai Konservasi Sumber Daya Alam Nusa Tenggara Barat, 2015).

Based on the ecological condition, a forest in Lombok Island has a large of macrofungi diversity. Edible macrofungi are one natural source that has the potential to be food and medicine (Haryati & Azrianingsih, 2012; Arko et al., 2017). Several species

of mushrooms have been cultivated for food sources such as *Auricula auricular* (Park et al., 2015; Chellappan et al., 2015; Reza et al., 2015; Zhao et al., 2015; Khaskheli et al., 2015; Cai et al., 2015; Arora et al., 2014), *Pleorotus* (Younis et al., 2015; Xue et al., 2015; Ren et al., 2015; Elbatrawy et al., 2015; Ganeshpurkar et al., 2015), and *Ganoderma* (Wang et al., 2015; Kladar, 2015; Zhang et al., 2015; Liang et al., 2015; Reis et al., 2015; Hossain et al., 2015; Huang et al., 2015). For the local, mushrooms have an essential role, not only as food but also it could be cultural aspects and traditional medicine sources (Garibay-Orijel et al., 2007; Arko et al., 2017). However, a piece of information about edible mushrooms in Lombok Island still on minimal data, especially the edible mushrooms population from Kerandangan Protected Forest & Natural Park. Therefore, in this present study, the characterization, identification, and composing of the identification guideline of edible mushrooms from Kerandangan Protected Forest & Natural Park have a goal to provide the data about the wild edible mushrooms diversity.

2. Material and Method

The sample was collected from the National park of Kerandangan Forest, West Lombok (Figure 1). Morphological identification has been made at the Laboratory of Biology, Faculty of Mathematics and Natural Sciences, University of Mataram. The sample of edible macrofungi was collected by the Cruise method (Rugayah et al., 2004). The cruise method was useful to collect more samples of macrofungi. The cruise was done following the specific track inside the forest.

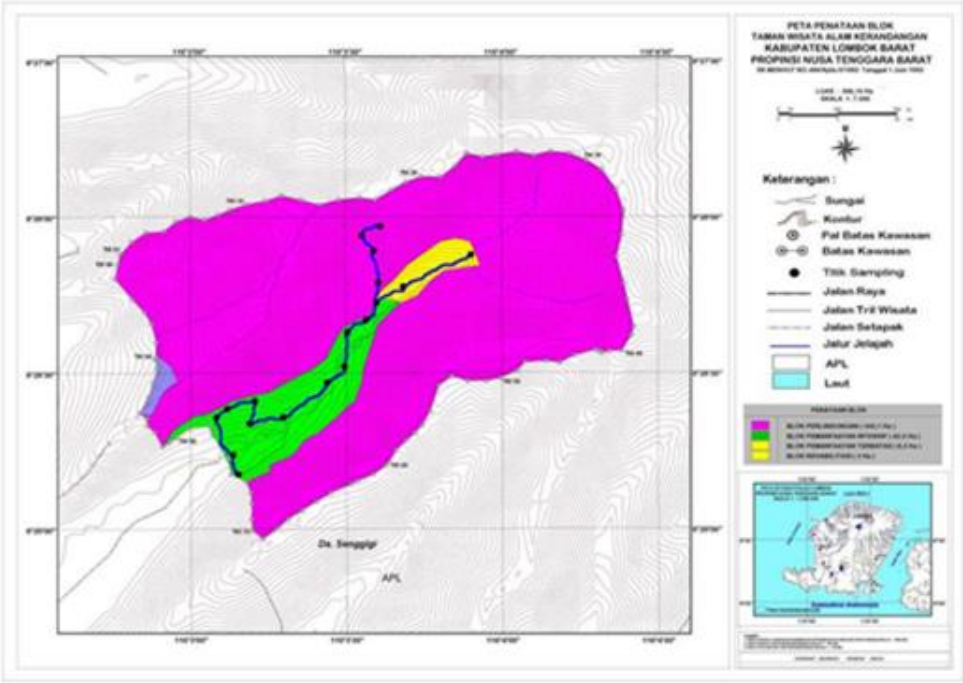

Figure 1. Map of Kerandangan Protected Forest & Natural a location of sampling (Source: Balai Konservasi Sumber Daya Alam Nusa Tenggara Barat, 2015)

Identification was performed by comparing the character of samples with the fungi identification guideline. The macroscopic analysis consists of the fungi's form and the color of the cap, the surface of the cap, cap type, the diameter of the cap, the form of stype, length and diameter of stype, appearance of the lamella, porus and annulus types, lamella, and volva type. The identification based on the Edible Mushroom Book, The Encyclopedia of Fungi of Britain and Europe (Jordan et al., 2004). Mushroom of West Virginia and the Central Appalachians and Mushrooms of the Pacific Northwest (Roody, 2003).

We used 13 morphological characters to determine the similarities between the eight samples. Those characters are converted to numerical values, and then the binary data were inputted into the software. The dendrogram tree was reconstructed using PAST 3.0. The cluster Analysis approach was conducted with Bray Curtis Index. Bray Curtis Index mentioned that if the similarity number is near to 1, which means they are closely related to each group.

3. Results and Discussion

Morphological characters and the Dendrogram tree was reconstructed using PAST 3.0. software. The cluster analysis was conducted with the Bray Curtis Index. The result of collecting and identification of edible macrofungi from Kerandangan Protected Forest & Natural Park was eight species (Figure 2). These species were divided into three Ordos, namely Agaricales, Tremellales, and Polyporales (Table 1).

Table 1. Classification of edible macrofungi found at Kerandangan Protected Forest & Natural Park

Ordo	Family	Genus	Species	Local Name	Substrate
Agaricales	Lyophyllaceae	Termytomyces	*Termitomyces clypeatus*	Tengkong Lentajam	Soil
			Termitomyces umkowaan	Tengkong Bulan	Soil
			Termitomyces sp. 1	Tengkong Bebadik	Soil
Tremellales	Pleorotaceae	Pleorotus	*Pleorotus flabellatus*	-	Deadwood
			Pleorotus ostreatus	Tengkong Kuling	Deadwood
	Coprinaceae	Coprinus	*Coprinus desimenatus*	-	Deadwood
	Tremellaceae	Tremella	*Tremella fuciformis*	-	Deadwood
Polyporales	Polyporaceae	Polyporus	*Polyporus sp*	-	Deadwood

According to our findings, we found that these macrofungus have different types of habitat, including soil and deadwood substrate. As shown in Table 1, the ordo of Agaricales has soil substrate, while both Tremellales and Polyporales have deadwood substrate. The type of substrate where the mushrooms grow is vital to ensure its grow

plentifully. Several factors affect the mushrooms' growth, including the type of vegetation, elevation, and temperature (Gezer & Kaygusuz, 2015).

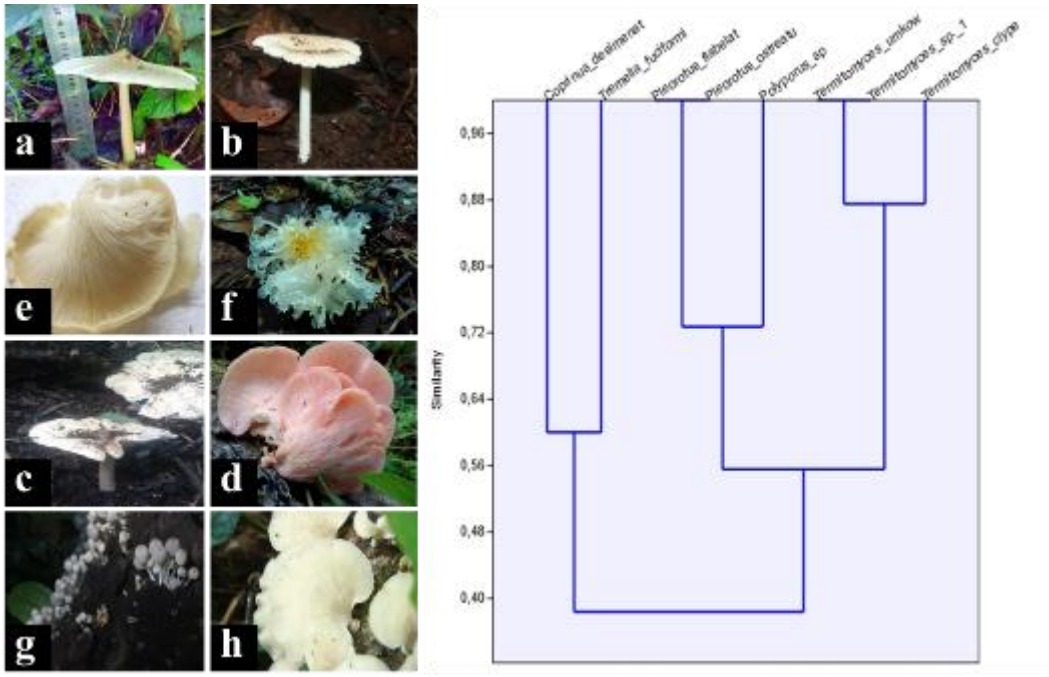

Figure 2. Edible mushrooms and it's phylogenetic three found in Kerandangan Protected Forest & Natural Park (a) *Termitomyces clypeatus* (b) *Termitomyces* sp. 1 (c) *Termitomyces umkowaan* (d) *Pleorotus flabellatus* (e) *Pleorotus ostreatus* (f) *Tremella fuciformis* (g) *Coprinus desimenatus* (h) *Polyporus* sp.

In this section, we explained the characters of each species (Table 2). *Termitomyces clypeatus* R. Heim (Lentajam mushroom) is a species of edible fungi accompanied with pileus sharp conical shape (cuspidate), smooth surface, notched edge (rimos) and has darker color edges than its surrounding. Furthermore, we found that this group has a pileus with a diameter of about 8-9.5 cm. The pileus is round parabolic with end pointed and dark brown color when in the early stage, then turning into white greyish with center pointed and darker color. This mushroom has branched gills or lamellae towards the edge (margin stipe) with free attachment to the stipe, and the edge of the gills is even. The long stipe of 18 cm with the bottom of stipe tapered as if forming pseudo root, white, central with a smooth surface, without annulus and volva, grow in groups with 10-12 basidiocarp.

Termitomyces umkowaan (Cooke & Massee) DA Reid has convex widened (broadly convex) to horizontal (flat) body fruit, color white slightly brownish with bulge brown center, flat edges sometimes split (rimos). Pileus diameter of 8 cm. Lamellae white with the tight arrangement (crowded). Further characters are cylindrical stipe with a round bottom (bulbous), flat surface, central, stipe size 14 x 6.5 cm, and without annulus. Grow solitary on the soil, usually found 2-3 basidiocarp in one place.

Termitomyces sp.1 known as manuk mushrooms (chicken mushroom) and society around Suranadi Natural Park called it Bebadik. Pileus convex widened (broadly

convex) to flattened with center curved inside, white, brownish, smooth surface, split edges (rimose). Pileus diameter of 5-6 cm. Lamellae branched towards the edge (margin stipe), lamellae attachment is stick to the stipe, base notched (emarginate), and smooth edge (even). Stipe equal, white, central with size 12 x 0.6 cm, without annulus and volva. Grow solitary on soil and found 1-2 basidiocarp in one place.

Pleorotus flabellatus Sacc, this mushroom found growing on dead fallen tree trunks. The fruiting body texture is a soft but not fragile, chewy, fleshy, fan-shaped, soft pink color with a smooth surface. Pileus edge rolls in (with rolled margin). Pileus diameter of 4 cm. Lamella is branched towards the edge (margin stipe). Stipe is very short with 0.5 cm long, sometimes does not appear, located on the side (sessile), without annulus and volva. Grow in groups and scattered in the substrate. Spore size 6.26 µm x 2.47 µm.

Pleurotus ostreatus (Jacq.) P. Kumm, this mushroom found growing on fallen tree trunks. The fruiting body is a fan-shaped, milky white color, chewy, fleshy, and the fruiting body will be soft and brittle when old. Pileus diameter of 3 cm, smooth surface, with rolled-in margin. Lamellae branched towards the edge (margin stipe). Stipe is very short with 0.5 cm long, sometimes does not appear to have one, located on edge (sessile). Grows in groups and scattered on the substrate. Spore size 5.98µm x 3.1µm.

Tremella fuciformis Berk. This mushroom has a shower puff shaped or crispy, fleshy and slimy, jelly-like texture, milky white color, and yellowing when old. Fruiting body diameter is 8-9 cm. Economically, this type of mushroom is popular as a food source. *Tremella fusiformis* found growing in litter and old wood. *Polyporus* sp. The texture of the flesh in the younger phase, like the type of *P. ostreatus*. The fruiting body is fan-shaped with a curved edge (umbonate), white to brownish and white when old, smooth surface sometimes downy on the edges. Pileus diameter is 3-7 cm and 0.5 cm thick. Short stipe less than 0.5 cm, sometimes not visible, sessile. The pores will be visible in the old phase. This fungus usually consumed in the young phase, Grows on an old tree. *Coprinus disseminatus* (Press.) Gray. The fruiting body is small. The pileus shape is resembling a convex bell, oval when young and broad convex when old, smooth surface, fine striped edges (translucent-striate). The fruiting body is white when young and becomes greyish when old. The pileus diameter is 1-2 cm. The lamellae are arranged regularly (regular), and the color is similar to the pileus. Small stipe with 0.2 x 2-3 cm long, equal, central, smooth and brittle surface, Grows in a clump, and on decaying trees. There is no report of people around the forest who consume it; according to Boa (2004), this fungus can be consumed, but other literature explains that it can be consumed only in the young phase.

Table 2. General morphological characters of edible mushrooms found at Kerandangan Protected Forest & Natural Park

No	*Species*	Umbrella shaped fruit body	Lamella	broadly convex Cap	Lamela branched to the edge	Sticking stipe (Free)
1.	*Termitomyces clypeatus*	√	√	-	√	-
2.	*Termitomyces umkowaan*	√	√	√	√	-
3.	*Termitomyces sp. 1*	√	√	√	√	-
4.	*Pleorotus flabelatus*	√	√	-	√	-
5.	*Pleorotus ostreatus*	√	√	-	-	-
6.	*Coprinus desimenatus*	√	√	√	-	-
7.	*Tremella fuciformis*	√	-	-	-	-
8.	*Polyporus sp.*	√	-	-	-	-

Almost all the edible macrofungi found in Kerandangan Protected Forest & Natural Park were from the phylum Basidiomycota. According to Dewi et al. (2019), Indonesia has a very high diversity of Basidiomycota; however, the comprehensive investigation is limit. The high diversity of Basidiomycota is caused by the humid environment and tropical temperatures. Commonly, the local of Indonesia were utilized the edible fungi as food and medicine source, including Auricularia, Volvariella, and Pleurotus (Arko et al., 2017; Dewi et al., 2019). The conservation strategy of Basidiomycota in the developed country showed the utilization of forest spaces for the cultivation of edible mushrooms (Dewi et al., 2019).

Conclusion

In this present study, we showed that there are eight species of edible mushrooms found, namely, *Termitomyces clypeatus*, *Termitomyces umkowaan*, *Termitomyces sp.1*, *Pleurotus flabellatus*, *Pleurotus ostreatus*, *Coprinus desimenatus*, *Tremella fuciformis*, and *Polyporus sp*. All of them involved in the Basidiomycota group. Based on characterization and identification, the species are grouped into three the Ordos and five Families. Most of the edible macrofungi *found at* Kerandangan Protected Forest & Natural Park growth at soil and deadwood.

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