Study on Diversity and Potency of Some Macro Mushroom at Gunung Gede Pangrango National Park

(Studi Keragaman dan Potensi Pemanfaatan Jamur Makro Di Taman Nasional Gunung Gede Pangrango)

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Submitted: 13 February 2019; Revised: 15 April 2019; Accepted: 22 September 2019

ABSTRACT

Biodiversity is a valuable asset which should be preserved and protected. Gunung Gede Pangrango National Park (GGPNP) is one of the conservation areas with a high level of biodiversity in Indonesia. Currently, mushroom diversity in GGPNP is rarely reported. Inventory of mushroom diversity is the first step of actions to maintaining germplasm and maximizing its potential usage in the future. In this paper, we explain how to use macroscopic characters to help identification of macro mushroom. The fungi collected from GGPNP were 19 species and 14 genera, including: Armillaria sp. 1, Armillaria sp. 2, Auricularia sp., Daedalea sp. 1, Daedalea sp. 2, Fomitopsis sp., Ganoderma sp. 1, Ganoderma sp. 2, Marasmius sp., Microporus sp. 1, Microporus sp. 2, Mycena sp., Phellinus sp., Polyporus sp., Rigidoporus sp., Russula sp., Sistotrema sp., Xylaria sp. 1, and Xylaria sp. 2. These mushroom could be potentially used as food and medicinal source.

Keywords: Biodiversity, mushroom, potency, GGPNP.
INTRODUCTION

Indonesia is a country with a tropical climate and ecosystem with dense rainforest which makes Indonesia one of the highly rich countries in biodiversity. One of them is mushroom biodiversity. Mushroom can grow in soil, wood, litter, animal feces, and others. Mushroom does not have chlorophyll, so they cannot provide their food. Based on its size, mushroom can be grouped into microscopic mushroom and macroscopic mushroom. Macroscopic mushroom includes some members of Basidiomycota and Ascomycota (Dwidjoseputro 1978).

There are still many species of mushroom in the world that have not been described and recorded properly, especially in tropical regions such as Indonesia. It is estimated that there are 1.5 million mushroom species in the world, in which around 28,700 of macroscopic mushroom, 24,000 of microscopic mushroom, and 13,500 types of lichens (symbiotic associations between mushroom and algae) had been identified while 1,433,800 species, for both macro and micro, had not been identified (Thomas and Gary 2002). Among these species, 1,800 are thought to have beneficial metabolites for treatment, while those containing toxins are only about 10%. Two hundred thousand (13.3%) of these species possibly exist in Indonesia (Gandjar et al. 2006). This makes the inventory of mushroom variations in Indonesia is an important step in efforts to utilize and conserve existing germplasm.

One of the areas which have high biodiversity is Gunung Gede Pangrango National Park (GGPNP) which is designated as a national park with a current area of 21,975 ha. Since this area has high biodiversity, thus encouraging UNESCO to establish a biosphere reserve. The existence of GGPNP has an important role and strategic value for human life. This area plays a role to support the advancement of regional and national economic development because the area is protected from excessive exploitation activities to preserve nature. To date, research related to the composition, diversity of mushroom species, their potential and utilization is very rarely done in GGPNP. The purpose of this study is to provide information of mushroom diversity in GGPNP as an effort to preserve biodiversity and ecosystems and their potential use in the future.

The study was conducted at GGPNP in July–August 2018. Data collection was done by exploration method referring to Puspitaningtyas (2007) and Priyanti (2008). Mushroom identification was carried out using macroscopic characters. Macroscopic identification characters including how to grow, fruit body shape, hygrophanous, young and old cap colour, cap diameter, upper and lower shape of cap, cap surface, cap edge, cap margin, wetness level, hymenophore type (lamellae, pores, teeth) including: how to attach to the stipe, length, distance between rows, and margins. Other characters observed were stipe shape, young and old stipe colour, stipe diameter and length, stipe surface, attachment position, stipe attachment type on the substrate, stipe cross-section, partial veil and universal veil, fruit body texture, odor, taste, and information on its use as food (edible or non edible) through interviews with key persons and literature studies to obtain data on local knowledge related to the use of mushroom in the area. Mushroom samples identified using several identification references including Largent and Stuntz (1977), Lincoff (1981), Arora (1986), McKnight and Vera (1998), and MycoKey application.

RESULT AND DISCUSSION

A total of 19 mushroom samples were collected from GGPNP. Samples were obtained from Mandalawangi Cibereum waterfall area. The entire mushroom found to grow on the soil, forest litter, and parasites on some plants. Most of the mushroom found as saprophytes which utilize organic matter in the surrounding environment. GGPNP has many large trees and results in a high number of litters on the forest floor which is a source of organic material for the mushroom to growth. The air relative humidity conditions in the GGPNP during collection were was 50%, while soil relative humidity is 58%, and the air
temperature was 20–23°C. The identification results of 19 samples showed that 17 fungal samples are Basidiomycota, while 2 other mushrooms are Ascomycota (Table 1).

The 19 specimens consisted of 14 genera and 19 species, namely: Armillaria sp. 1, Armillaria sp. 2, Auricularia sp., Daedalea sp. 1, Daedalea sp. 2, Fomitopsis sp., Ganoderma sp. 1, Ganoderma sp. 2, Marasmius sp., Microporus sp. 1, Microporus sp. 2, Mycena sp., Phellinus sp., Polyporus sp., Rigidoporus sp., Russula sp., Sistotrema sp., Xylaria sp. 1, dan Xylaria sp. 2. Each mushroom has different characteristics (Table 1).

The mushroom diversity obtained from the GGPNP area in this study was quite low. There were only 19 species found around Mandalawangi and Cibereum Waterfall. This is likely due to dry conditions and low rainfall during the research period. The relative humidity conditions of the air in GGPNP during the study period were 50%, soil relative humidity 58%, and air temperature 20–23°C. Mushroom growth is influenced by various environmental factors. Thomas and Gary (2002) reported that temperature and relative humidity in the ecosystem affect the development of fungal hyphae. Physical factors that greatly influence the life of mushroom are including temperature, humidity, altitude, and pH of the substrate. The best condition for macroscopic mushroom growth to produce fruit body is in the winter or rainy season (Pacioni 1981). According to Praborini (2012), in the rainy season, air humidity and substrate humidity are higher than in the dry season. This affects the development of spores.

The phylum of Basidiomycota found in this study was divided into 11 families, 13 genera, and 17 species. On the other hand, Ascomycota were found to be less compared to Basidiomycota. Two species of Ascomycota found were the members of Xylaria from Xylariales which grows on dead tree branches. According to Teke et al. (2018), Xylaria can be used as a cure for breast cancer, but no information has been found regarding the use of this mushroom as food or medicine in GGPNP.

**Armillaria sp. 1**

In the GGPNP, Armillaria sp. 1 was found to grow on dead tree trunks. The fruiting body of Armillaria sp. 1 had a cap with lamella and a stipe (Figure 1b). The color characteristic of the cap was brownish-orange in colour and undergoes discolouration from brownish-white ivory when young, and brown when old. The cap diameter was 4 cm with convex upper shape and round at underside. The surface of the cap was thread-like structure, the entire edge with an incurved margin (Figures 1a and 1c). The wetness of Armillaria sp.

| Phylum       | Class               | Order            | Family          | Genus | Species         |
|--------------|---------------------|------------------|-----------------|-------|-----------------|
| Ascomycota   | Sordariomycetes     | Xylariales       | Xylariaceae     | Xylaria | Xylaria sp. 1   |
| Basidiomycota| Agaricomycetes      | Agaricales       | Auriculariaceae | Auricularia | Auricularia sp. |
|              |                     |                  | Marasmiaceae    | Marasmius | Marasmius sp.   |
|              |                     |                  | Mycenaceae      | Mycena  | Mycena sp.      |
|              |                     |                  | Physalaciaceae  | Armillaria | Armillaria sp. 1 |
|              |                     |                  |                 |         | Armillaria sp. 2 |
|              |                     | Cantharellales   | Hydnaceae       | Sistotrema | Sistotrema sp.  |
|              |                     | Polyporales      | Himenochaetaeae | Phellinus | Phellinus sp.    |
|              |                     |                  | Formitopsidaceae| Fomitopsis | Fomitopsis sp.  |
|              |                     |                  |                 | Daedalea | Daedalea sp. 1  |
|              |                     |                  |                 |         | Daedalea sp. 2  |
|              |                     | Ganodermataceae  | Ganoderma       | Ganoderma | Ganoderma sp. 1 |
|              |                     | Meripilaceae     | Rigidooporus    | Rigidooporus | Rigidooporus sp. |
|              |                     | Polyporaceae     | Microporus      | Microporus | Microporus sp. 1 |
|              |                     |                  |                 |         | Microporus sp. 2 |
|              | Speciales           | Russulae         | Russula         |     | Russula sp.     |

In the GGPNP, Armillaria sp. 1 was found to grow on dead tree trunks. The fruiting body of Armillaria sp. 1 had a cap with lamella and a stipe (Figure 1b). The color characteristic of the cap was brownish-orange in colour and undergoes discolouration from brownish-white ivory when young, and brown when old. The cap diameter was 4 cm with convex upper shape and round at underside. The surface of the cap was thread-like structure, the entire edge with an incurved margin (Figures 1a and 1c). The wetness of Armillaria sp.
1 was moist. The hymenophore type in Armillaria sp. 1 was lamella which attaches to the stipe by notching. In the entire type of lamella at the margin, it had length of 1.7 cm which is short distance between rows. The stipe of Armillaria sp. 1 was cylindrical with light brown to ivory white colour. The stipe length was 5.6 cm with a surface thread structure when old and scaly when young. The position of attachment to cap was central and the type of attachment to the substrate was basal. The flesh of stipe was hollow, with a partial veil in the superior position. Armillaria sp. 1 did not have a universal veil. Fruit body texture was soft with smells of soil and had a flavorless taste.

**Armillaria sp. 2**

Armillaria sp. 2 was found in GGPNP grow on tree trunks as parasite. The fruiting body of Armillaria sp. 2 had a cap with lamella and stipe (Figure 2a and 2c). The colour characteristic of the cap was cream with brown in the middle part. The cap diameter was 5 cm with flat upper shape and round at underside. The surface of the cap was smooth, the entire edge with an incurved margin and flat to lobe at the margin (Figures 2c). The wetness of Armillaria sp. 2 was moist. The hymenophore type in Armillaria sp. 2 was lamella which attaches to the stipe by decurrent. Lamela length was 1.6 cm with a short distance between rows, the margin type was entire. The stipe of Armillaria sp. 2 was cylindrical with brown and blackish colour. The stipe length was 5 cm with fibrillose structure, the position of attachment to cap was central; the type of attachment to the substrate was basal. The flesh of stipe was hollow, with a partial veil in the superior position. Armillaria sp. 2 did not have a universal veil. Fruit body texture was soft with smells of soil and had a sweet taste.

**Auricularia sp.**

Auricularia sp. was found in GGPNP grow in the colony on a dead tree as a saprobe. The fruiting body of Auricularia sp. was jelly. The size of one colony was 20 cm in diameter and 6 cm in diameter as an individual (Figure 3a). Auricularia sp. had an irregular top and bottom shape (Figure 3b), the top surface of the pileus had a relatively finer texture compared to the lower surface. Auricularia sp. had a flat edge on the fruit body and slightly curved margin (incurved). Auricularia sp. had a hymenophore pore type with irregular pore shape and close inter-pore attachment.

**Figure 1.** Characteristics of macroscopic identification of Armillaria sp. 1.

**Figure 2.** Characteristics of macroscopic identification of Armillaria sp. 2.
Auricularia sp. had soft fruit body texture which smell like soil and flavorless.

Daedalea sp. 1

Daedalea sp. 1 found in GGPNP grow in groups with gregarious spacing. Daedalea sp. 1 has a body of brackets equipped with pores as himenophore (Figure 4d). The fruit body colour is ivory white at young stage, changes to brown when old. The fruit body has a diameter of 6 cm to 15 cm with a flat top shape and irregular bottom shape (Figures 4c and 4d). The surface of the fruit body is smooth and wavy, the edge is entire to undulate (Figures 4b and 4d) with a flat margin. The wetness of Daedalea sp. 1 is very dry. The himenophore type in Daedalea sp. 1 is a pore that is non-detachable with a round shape (Figure 4a). The fruit body attach directly to the substrate. Daedalea sp. 1 does not have a stipe and its fruit body texture is soft to hard with smell of soil.

Daedalea sp. 2

Daedalea sp. 2 was found in GGPNP grow in solitary. Daedalea sp. 2 had a body of brackets equipped with pores as hymenophore (Figure 5a and 5b). The fruit body colour was light brown with a circular line of brown and ivory white (Figure 5a), changes to dark brown when old. The fruit body had a diameter of 5.2 cm to 11 cm with a flat top shape and spathulate at the bottom shape. The surface of the fruit body was rough, the edge was entire (Figure 5a) with a straight margin until slightly incurved. The wetness of Daedalea sp. 2 was dry. The hymenophore type in Daedalea sp. 2 is a non-detachable pore with a very small round shape and tightness. Daedalea sp. 2 mushroom fruit body attaches to the substrate as sessile. The fruit body attaches directly to the substrate. Daedalea sp. 2 did not have a stipe and its fruitbody texture was soft to hard with the smell of soil.

Figure 3. Characteristics of macroscopic identification of Auricularia sp.

Figure 4. Characteristics of macroscopic identification of Daedalea sp. 1.

Figure 5. Characteristics of macroscopic identification of Daedalea sp. 2.
**Fomitopsis sp.**

*Fomitopsis sp.* grew on fallen tree trunks in colonies with a flat and fan-shaped fruit body. *Fomitopsis sp.* had fruit body with ivory white colour and 2.5 cm in diameter. The shape was crust at upperside and fan-like structure at the bottom. The fruit body surface was fibrillose, lobed to the crenate edge with flat margin, and dry wetness level (Figure 6b). Hymenophores were round pores. The pseudotype was light brown with a diameter of 1.8 cm and length of 2.1 cm. The surface was rough (Figure 6a) and hard fruit body texture with soil odor and flavorless.

**Ganoderma sp. 1**

*Ganoderma sp. 1* was found in GGPNP grow in groups with scattered spacing. *Ganoderma* had a bracket-shaped fruit body (Figure 7b). The characteristics of the fruit body were light brown and change to dark brown when old. The fruit body had a diameter of 5.5 cm (Figure 7a), with flat top shape and irregularly bulging-shape at the bottom. The surface was rough (Figure 7c), the edge is entire to undulate with a straight margin to incurved (Figure 7b). The wetness of *Ganoderma sp. 1* was very dry. The hymenophore type was non-detachable pore with a round shape. *Ganoderma sp. 1* attach directly to the substrate (sessile). The body texture of *Ganoderma sp. 1* was hard and had a smell of soil.

**Ganoderma sp. 2**

*Ganoderma sp. 2* was found to grow in groups with a gregarious pattern. The characteristics of the fruit body was dark brown (Figure 8a). The fruit body had a diameter of 6 cm with a flat top shape and half-circle shape at the bottom side. The surface was rough, the edge was entire with a straight margin (Figure 8b). The wetness of *Ganoderma sp. 1* was very dry. The hymenophore type was non-detachable pore with a round shape. *Ganoderma sp. 1* attach directly to the substrate (sessile). The body texture of *Ganoderma sp. 2* was hard and had a smell of soil.

**Marasmius sp.**

The *Marasmius sp.* was found to grow solitary in the soil in the GGPNP. The fruiting body of *Marasmius sp.* was a cap with lamella and stipe. The brownish cap was 1.2 cm in diameter with the convex shape at upperside and round at underside (Figure 9b and 9d), the surface of the cap was smooth with the entire edge, straight margins, and slightly moist wetness of the cap (Figure 9a and 9c). This mushroom had hymenophore lamella type with free lamellar attachment type (Figure 9a),

![Figure 6. Characteristics of macroscopic identification of Fomitopsis sp.](image1)

![Figure 7. Characteristics of macroscopic identification of Ganoderma sp. 1.](image2)
the lamellar length of 0.8 cm, with medium distance between lines with a smooth margin. The stipe of *Marasmius* sp. was cylindrical in colour, with brownish stipe length of 2.8 cm. The surface of the stipe was smooth, the attaching type to the cap was central and hollow stipe. The body texture of *Marasmius* was smooth with the smell of wet soil and flavorless.

**Microporus sp. 1**

*Microporus* sp. 1 found in GGPNP grew solitary. The characteristic of the cap was predominantly dark brown colour with light brown circular lines and white at the edge (Figure 10a). The colour changes from dark brown when young to black when old. The cap diameter was 3.5 - 5.4 cm with the shape of a funnel-shaped and rounded round shape. The surface of the cap was rough, edges crenate (Figure 10a) with an upturned cap margin (Figure 10b). The wetness level of *Microporus* sp. 1 was dry. The hymenophore type was a pore which non-detachable with a round shape. *Microporus* sp. 1 had cylindrical stipe, yellowish light brown colour, with a length of 1.6 cm. The stipe surface tend to smooth, the position of the stipe attache was central (Figure 10c). The type of attachment was basal momentum to the substrate. Stipe was solid without both partial veil and universal veil. *Microporus* sp. 1 fruit body texture was hard with the smell of soil.

**Microporus sp. 2**

*Microporus* sp. 2 also grew solitary in tree branches with pores and stipe. The characteristic of colour was darker than *Microporus* sp. 1 (Figure 11a). The cap diameter was 5.4 cm (Figure 11c) with the shape of a funnel and round at bottom shape (Figure 11b). The surface cap was rough, the edges were lobed (Figure 11a) with the margin of the cap upturned (Figure 11b). The wetness level of

![Figure 8. Characteristics of macroscopic identification of *Ganoderma* sp. 2.](image)

![Figure 9. Characteristics of macroscopic identification of *Marasmius* sp.](image)

![Figure 10. Characteristics of macroscopic identification of *Microporus* sp. 1.](image)
Microporus sp. 2 was dry. The hymenophore type was a non-detachable pore with a round shape. Microporus sp. 2 had cylindrical stipe, with yellowish light brown colour and length of 2.3 cm (Figure 11b). The surface of the stipe was smooth, the position of attaching stipe to the cap was central and attachment to the substrate was basal tomentum. The flesh of stipe was solid without partial veil and universal veil. Microporus sp. 2 had different line motif on the part of the cap compared to Microporus sp. 1.

Mycena sp.

Mycena sp. found in GGPNP grew solitary on tree trunks. The fruit body of Mycena sp. was a cap with lamella and stipe. The colour of the cap was cream when young and brownish when old. The cap diameter was 2.5 cm (Figure 12c) with convex at upperside and round shape at the bottom (Figure 12a). The surface cap was smooth, edges were crenate with an incurved margin (Figures 12a and 12b). The wetness level was moist. The hymenophore type was lamella attached to the stipe by notching. Lamella length was 1.3 cm with a short distance between rows, undulate at the margin. The stipe was cylindrical with light brown to ivory white colour. The length of the stipe was 2.3 cm with the surface covered with fibril, the position of attachment was central to the cap and the type of attachment to the substrate was basal. The stipe was solid without partial veil or universal veil. The fruit body texture was soft with the smells of soil and flavorless.

Phellinus sp.

Phellinus sp. found in GGPNP had an irregular shape, grew solitary in the forest with the substrate of tree roots, and stem base. The fruit body type was a bracket. Phellinus sp. had a cap with reddish-orange colour. The shape of the fruit body was irregular in both upper and lower part (Figure 13.a). The fruit body width was 4 cm.
(Figure 13.b), the upper surface is semi-globose and smooth edges with dry to moist wetness. The pore type of hymenophores was with round pore shape. *Phellinus* sp. did not have a stipe and attaches directly to the substrate. The body texture of the fruit was hard with a smell like a wet litter.

**Polyporus sp.**

*Polyporus* sp. was found in GGPNP grow in the colony on tree trunks. The fruit body had a porous cap with a stipe. The cap colour was white with a diameter of 3.7 cm (Figure 14a). The upper shape of the cap was convex and fan-like structure at the lower shape. The cap surface was smooth with the margin was edge entire to incurved (Figure 14b and 14c). *Polyporus* wetness level was moist. The hymenophore type was a detachable pore with a faceted and aspect. The stipe was tapered downward with white colour. The stipe length was 0.8 cm with a smooth surface, the attachment position was terminal (Figure 14c), attachment to the substrate was basal. The stipe was solid without partial veil or universal veil. The fruit body texture was soft, smell like soil, and flavorless.

**Rigidoporus sp.**

*Rigidoporus* sp. found in GGPNP lived as a colony on the dead log. This mushroom had a brownish-white at old fruit body and yellowish-brown in the young stage. The upper shape of the cap was convex with a rough surface and large serrated at edges and incurved margin (Figure 15a). Fruit body width was 12 cm (Figure 15b and 15c). The wetness level was quite dry. The hymenophore type was teeth, without stipe (Figure 15d). The texture of the fruit body was soft with soil odor and bitter taste.

**Russula sp.**

*Russula* sp. found in GGPNP grew solitary on the ground. The fruit body had a cap with lamella and stipe (Figure 16a). The cap colour was white with a diameter of 5.5 cm (Figure 16c), the upper shape type was depressed (Figure 16b) and round at bottom shape. The surface of the cap was smooth, the edge was entire with an incurved margin (Figure 16b). The wetness level was moist. Hymenophore type was lamella which attaches to stipe by adnate. The lamella length was 3.1 cm and had a short distance between row and smooth margin. The stipe was cylindrical and had a white colour. The stipe height was 3 cm (Figure 16d) with thread-like surface, the position of attachment on the cap was central and the type of attachment on the substrate was basal. The flesh of stipe was solid, without partial veil or universal veil. The fruit body texture was soft with smells of soil and flavorless.
**Sistotrema sp.**

*Sistotrema sp.* found in GGPNP grew solitary in tree branches with a cap and teeth hymenophore and had pseudo-stipe. The cap colour was predominantly white. The cap diameter was 2.1 cm (Figure 17.d) with a funnel shape (Figure 17.a). The surface of the cap was rough (Figure 17.b), edges were crenate with an upturned cap margin (Figure 17.c). The wetness level was dry. The Hhyimenophore type was non-detachable with round shape. *Sistotrema sp.* had a light yellowish cylindrical stipe (Figure 17c), with a length of 0.8 cm. The surface of the pseudo-stipe tend to be smooth, the stipe position of attaching to cap was central and, the attachment to the substrate was basal. The flesh of stipe was solid, without a partial and universal veil. The fruit body texture was hard and had smell of soil.

**Xylaria sp. 1**

*Xylaria sp.* 1 found in GGPNP grew solitary and group with gregarious spacing in dead tree branches. *Xylaria sp.* 1 colour was grayish-white. The surface of this mushroom was white and grayish and covered with pale fine powder with a black base. The fruit body was cylindrical (Figure 18). A hard stroma grow upright with a length of 8–10 cm and 0.7 cm of thick.

![Figure 16. Characteristics of macroscopic identification of Russula sp.](image)

![Figure 17. Characteristics of macroscopic identification of Sistotrema sp.](image)

![Figure 18. Characteristics of macroscopic identification of Xylaria sp. 1.](image)


**Xylaria sp. 2**

*Xylaria sp.* 1 found in GGPNP grew solitary in dead tree branches. *Xylaria sp.* 1 colour was brown. The surface of this mushroom was brown and covered with a pale fine powder. The fruit body was cylindrical with an enlarged tip resembling a mace (Figure 18). A hard stroma grow upright with a length of 7 cm and 2 cm thick.

The identification result showed that the diversity of mushroom in the GGPNP was dominated by the Polyporales from the Basidiomycota phylum. Most of the mushroom belonging to the Polyporales is the group of fungi that live seasonally, but some can live within a few years (Susan and Retnowati 2017). The living style of the Polyporales order is mostly saprophytes on the trunks or the tree branches. Polyporaceae can survive in dry areas so that they can be found in areas with relatively high-temperature conditions. This is in line with Wahyudi et al. (2012), Microporus is easily found in almost every forest that has similar environmental conditions. Noverita et al. (2017) said that Polyporales are a group of fungi which able to adapt to environmental conditions with the less supportive condition to grow.

Some Polyporales found in GGPNP were Formitopsidaceae, Ganodermataceae, and Polyporaceae. Polyporaceae is one of the largest families with wide range of colours, shapes, and sizes. Polyporaceae has a common bracket or fan characteristic with a hymenophore in the form of a small hole. In this study, we found six genera of the Polyporales namely: *Daedalea*, *Fomitopsis*, *Ganoderma*, *Microporus*, *Polyporus*, and *Rigidoporus*. *Microporus* is the common genus that grows in the GGPNP area and is often found along the path to the Cibereum Waterfall. This result confirmed the data provided by Rezky et al. (2012) who reported that mushrooms in GGPNP were dominated by *Microporus* and *Polyporus*. According to Benedict and Brady (1972), *Microporus* sp. can be used as an antibacterial for *E. coli* and *S. aureus*. Some *Polyporus* can be used as a cure for cancer and liver disease (Ayeka 2018). Also, the Polyporales that grow in the Mandalawangi area is Ganodermataceae. Ayeka (2018) stated that several species of *Ganoderma* can be used as medicines for cervical cancer, prostate cancer, lung cancer, and liver cancer. Other genera of the Polyporales order found were *Daedalea*, *Fomitopsis*, and *Rigidoporus*. Research on the potential of these mushrooms in Indonesia has never been done. Secondary metabolites from *Daedalea* are optimized as anti-cancer and anti-inflammatory substances (Gebhardt et al. 2007; Yassin et al. 2008), metabolites from *Fomitopsis* have inhibitory activity against *Bacillus subtilis* (Keller et al. 1996), and *Rigidoporus* is used as an alternative biopharmaceutical source in the world of health (Cheng et al. 2009).

The second-largest order found in GGPNP was Agaricales. A common characteristic of Agaricales is the fruit body shape like an umbrella and lamella hymenophore type, fleshy, short life cycle, and experiences a faster decay process (Susan and Retnowati 2017). Some families of the

![Figure 19. Characteristics of macroscopic identification of Xylaria sp. 2.](image)
order of Agaricales found were Auriculariaceae, Marasmiaceae, Mycenaceae, and Physalacriaceae. The diversity of Agaricales that grew on the hiking trail to Cibereum Falls in GGPNP was quite low. Christita et al. (2017) reported that Agaricales was very common in the tropical forests of Sulawesi. In this study, we found four genera from the order Agaricales namely Armillaria, Auricularia, Marasmius, and Mycenae. Armillaria that has been identified in GGPNP grew as a parasite in trees. Until date, there are only around 70 species of Armillaria in the world. The diversity of this genus in the tropical area has the potential to describe new species that have never been reported before. There is no information about this genus as medicine or food ingredient in GGPNP. Several studies have reported that Armillaria has the potential as a source of antioxidants and antiedema (Lai and Ng 2013; Strapáč et al. 2016). Auricularia found in GGPNP is an edible mushroom which has potential as healthy food. The nutritional content Auricularia is 89.1% water, 4.2% protein, 5.3% fat, 2.8% carbohydrate, 19.8% fiber, and 351 mg calories (Chang and Miles 1989). Al Ulya et al. (2017) reported that Auricularia or Supa Ceuli (local language) is often used as food sources in the Banten area. The next genus found was Marasmius. Marasmius is a large group and spread to more than 600 species in the world. This mushroom has an ecological function as decomposer on the forest floor. Desjardin et al. (2000) described 37 species of Marasmius from Java and Bali, and 12 of them were new species. The chance for describing the new species of Marasmius in Indonesia is very large considering the vast tropical forest area. Marasmius is easily found in both wild forest areas and tourist areas (Putra et al. 2017, 2018). Putir et al. (2008) reported that several types of Masrasmius sp. can be used as medicine. The last genus of the order Agaricales from GGPNP was Mycenae. This genus is also good decomposer. Some species of Mycenae are a group of fungi that can fluoresce (Desjardin et al. 2007). Liang et al. (2019) succeeded isolating the polysaccharide which has the potential as an antioxidant from M. Dendrobii.

The next order found in GGPNP was Cantharellales. The genus that was successfully described is Sistotrema. di Marino et al. (2008) confirmed that based on DNA sequence analysis, this genus was an ectomycorrhiza group although no research was performed on GGPNP that indicated that Sistotrema was a mycorrhizal group. Phellinus is the genus of order Himenochoetales found in GGPNP. Studies on Phellinus are still rare in Indonesia both in terms of taxonomic aspects and their uses. Phellinus extracts are reported to have anti-cancer activities (Konno et al. 2015) and antioxidants (Yang et al. 2011). The Russula was the only genus of order Russulales found in this study. The Russula collected from GGPNP was different species from the Russula reported by Darwo and Sugiantari (2008) in North Sumatra. Zhang et al. (2010) isolated lectins from Russula which had potential as anti-tumor activity.

CONCLUSION

A total of 19 species and 14 genera were collected from GGPNP in this study. Mushroom identification was carried out using various macroscopic characters. The mushrooms were: Armillaria sp. 1, Armillaria sp. 2, Auricularia sp., Daedalea sp. 1, Daedalea sp. 2, Fomitopsis sp., Ganoderma sp. 1, Ganoderma sp. 2, Marasmius sp., Microporus sp. 1, Microporus sp. 2, Mycenae sp., Phellinus sp., Polyporus sp., Rigidoporus sp., Russula sp., Sistotrema sp., Xylaria sp. 1, and Xylaria sp. 2. Some mushroom found to be potentially used as food and medicine.

ACKNOWLEDGMENT

This research was supported by GGPNP and Department of Biology, IPB University.
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