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**DIVERSITY AND POTENTIAL UTILIZATION OF  
SOME WILD MACROSCOPIC FUNGI AROUND  
IPB UNIVERSITY CAMPUS BUILDING**

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**Abstract**

Mushroom are cosmopolitan organisms which can emerge in a variety of environment, and around the university building is no exception. The goal of this study was to collect information on macrofungi diversity around IPB University Campus Building in order to be used as a reference for its potential in the future. Macrofungi collection was done by opportunistic sampling method. All mushrooms found were Basidiomycota, which dominated by order of Agaricales. A total of 13 mushrooms were identified and described in this study, namely: *Armillariella* sp., *Marasmiellus* sp., *Mycena* sp., *Agrocybe* sp., *Polyporus* sp., *Entoloma* sp., *Xeromphalina* sp., *Paxillus* sp., *Lentinus* sp. 1, *Lentinus* sp. 2, *Collybia* sp., *Pluteus* sp., and *Parasola* sp. Some macroscopic fungi found to be potentially used as a bioactive compound sources, medicine and also played an important role as a decomposer in the sampling site.

**Keywords:** *Campus building, Mushroom, Diversity, Potency, IPB University*

**Abstrak**

Jamur makroskopis merupakan organisme kosmopolitan yang mampu tumbuh pada berbagai macam kondisi lingkungan, tidak terkecuali di sekitar bangunan universitas. Tujuan dari penelitian ini adalah menyediakan informasi mengenai keragaman jamur makroskopis di sekitar kampus Institut Pertanian Bogor untuk pemanfaatannya di masa mendatang. Eksplorasi jamur dilakukan dengan metode pengambilan sampel oportunistik. Semua jamur yang ditemukan merupakan filum Basidiomycota dan didominasi oleh ordo Agaricales. Sebanyak 13 jenis jamur makro berhasil diidentifikasi dan dideskripsikan pada penelitian ini, yaitu: *Armillariella* sp., *Marasmiellus* sp., *Mycena* sp., *Agrocybe* sp., *Polyporus* sp., *Entoloma* sp., *Xeromphalina* sp., *Paxillus* sp., *Lentinus* sp. 1, *Lentinus* sp. 2,



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*Collybia* sp., *Pluteus* sp., dan *Parasola* sp. Beberapa Jamur diketahui berpotensi sebagai sumber bahan bioaktif, obat-obatan, dan dekomposer penting pada ekosistem.

**Kata Kunci:** Gedung kampus, Jamur, Ragam, Potensi, IPB

Mushroom is generally described as macrofungi with distinctive fruit body which can be either epigenous or hypogeous and sizeable to be seen with the eye and to be collected by hand (Lodge *et al.*, 2004). Macrofungi are well known as cosmopolitan and heterotrophic organisms in the environment. They arise seasonally or at any time in various habitats such as: humus soil, decaying plant litter, pathogen on the plant, wood logs in forests, and even in sandy and other types of soils.

Mushroom diversity information is an essential part of fungal diversity. The known number of fungi (micro and macro) species is approximately 100,000 of the estimated 5,000,000 species in the world (Blackwell, 2011). The tropical region, which is undoubtedly posing high mycodiversity has been inadequately observed and the mycoflora scarcely documented (Hawksworth, 2001), and Indonesia is no exception.

Macro fungi diversity data collection has not been done systematically in Indonesia. In 2019, Indonesian Institute of Sciences (LIPI) reported that until 2017, there were only 2273 species of mushrooms in Indonesia or only about 0.15% of the total number of species in the world. Macrofungi are an often neglected component of biodiversity assessment, though they equally hold important genetic diversity with significant potential

implication in nature and human welfare.

Appropriate knowledge of mushroom diversity and distribution is imperative for successful management and optimum utilization of the ecosystem for numerous benefits to mankind (Nwordu *et al.*, 2013; Putra, 2020b). A simple contribution which can be made by any mycologists is to get involved in providing diversity data of macrofungi around them, including educational institutions. IPB University is one of the campuses in areas with high rainfall around campus building which making the condition suitable for mushroom development. Till date, only few comprehensive informations provided (Putra *et al.*, 2019b; Putra 2020a) regarding mushroom diversity and potency around IPB University Campus Building (IPBUCB). Thus, the goal of this study was to examine macrofungi diversity and its potential utilization.

## **MATERIAL AND METHOD**

The study was conducted around IPBUCB (Fig 2) in March-April 2018. Data collection was done by opportunistic sampling method as described by Prayudi *et al.*, (2019). Mushroom identification was carried out using some macroscopic characters referring to (Putra *et al.*, 2018). Macroscopic identification parameters including how mushroom grow, fruit body shape,

hygrophanous, cap color when young and mature, cap diameter, the 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, stipe color (young and mature stage), 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 literature studies to obtain data related to the use of fungi. Mushroom samples identified using several identification references, including (Arora, 1986; Maekawa *et al.*, 2013; Desjardin *et al.*, 2014; Læssøe *et al.*, 2019).

## RESULT AND DISCUSSION

A total of 13 mushroom samples were identified and described in this study. The macrofungi are divided into 3 orders and consist of 10 families (Table 1). All mushrooms found were Basidiomycota, namely: *Armillariella* sp., *Marasmiellus* sp., *Mycena* sp., *Agrocybe* sp., *Polyporus* sp., *Entoloma* sp., *Xeromphalina* sp., *Paxillus* sp., *Lentinus* sp. 1, *Lentinus* sp. 2, *Collybia* sp., *Pluteus* sp., and *Parasola* sp. The mushroom found was dominated by order of Agaricales. Members of the Agaricales are distributed worldwide with many representatives in tropical and temperate regions and a few species in arctic-alpine areas and deserts (Vellinga, 2004). In

Indonesia, Putra *et al.*, (2017; 2018; 2019a; 2019b) and Putra (2020a) reported that Agaricales always found both in the natural and tourism areas.

Mushrooms are both ecology and economically important. Thus, it is a very critical aspect to maintain macrofungi diversity. The first step to reach the goal is by providing comprehensive data of its diversity. Each mushroom found in this research has different characteristics. The following are the description of the mushroom of IPBUCB and their characters.

### *Armillariella* sp.

*Armillariella* sp. was found growing on bamboo stems in scattered group style. The pileus color is black-yellow to brownish and changed after the time (hygrophanous). Cap diameter is 2.7 cm, convex at the upper shape, rounded at the underside, with a knob in the middle of pileus. The mature cap becomes more wrinkled and curled to the bottom side. The surface of pileus is smooth, cap margin curves slightly, and wet of the wetness level. Hymenophore type is lamella (Fig 1.A) with dense spacing between rows, pale yellow in colour, which attaches to the stipe by notching type. A cylindrical stipe with 3.5 cm in length, fibrillose surface, and consistent diameter size from pileus to the base (Fig 1.B). The flesh of stipe is stuffed with no partial veils nor universal. Fruit body texture is soft with smells of soil and has a bitter taste. Wu *et al.*, (2007) reported that *Armillariella mellea* used as a popular medicinal fungus used in traditional Chinese medicine for treating headache, neurasthenia, and insomnia. Till date, there is no

information about the utilization of *Armillariella* found in IPBUCB.

Table 1 Mushroom Diversity Around IPB University Campus Building

Phylum	Class	Order	Family	Species	
Basidiomycota	Agaricomycetes	Agaricales	Physalacriaceae	<i>Armillariella</i> sp.	
			Omphalotaceae	<i>Marasmiellus</i> sp.	
			Strophariaceae	<i>Agrocybe</i> sp.	
			Entolomaceae	<i>Entoloma</i> sp.	
			Mycenaceae	<i>Xeromphalina</i> sp.	
				<i>Mycena</i> sp.	
				<i>Pluteus</i> sp.	
			Tricholomataceae	<i>Collybia</i> sp.	
			Psathyrellaceae	<i>Parasola</i> sp.	
			Boletales	Paxillaceae	<i>Paxillus</i> sp.
			Polyporales	Polyporaceae	<i>Polyporus</i> sp.
					<i>Lentinus</i> sp.1
					<i>Lentinus</i> sp.2

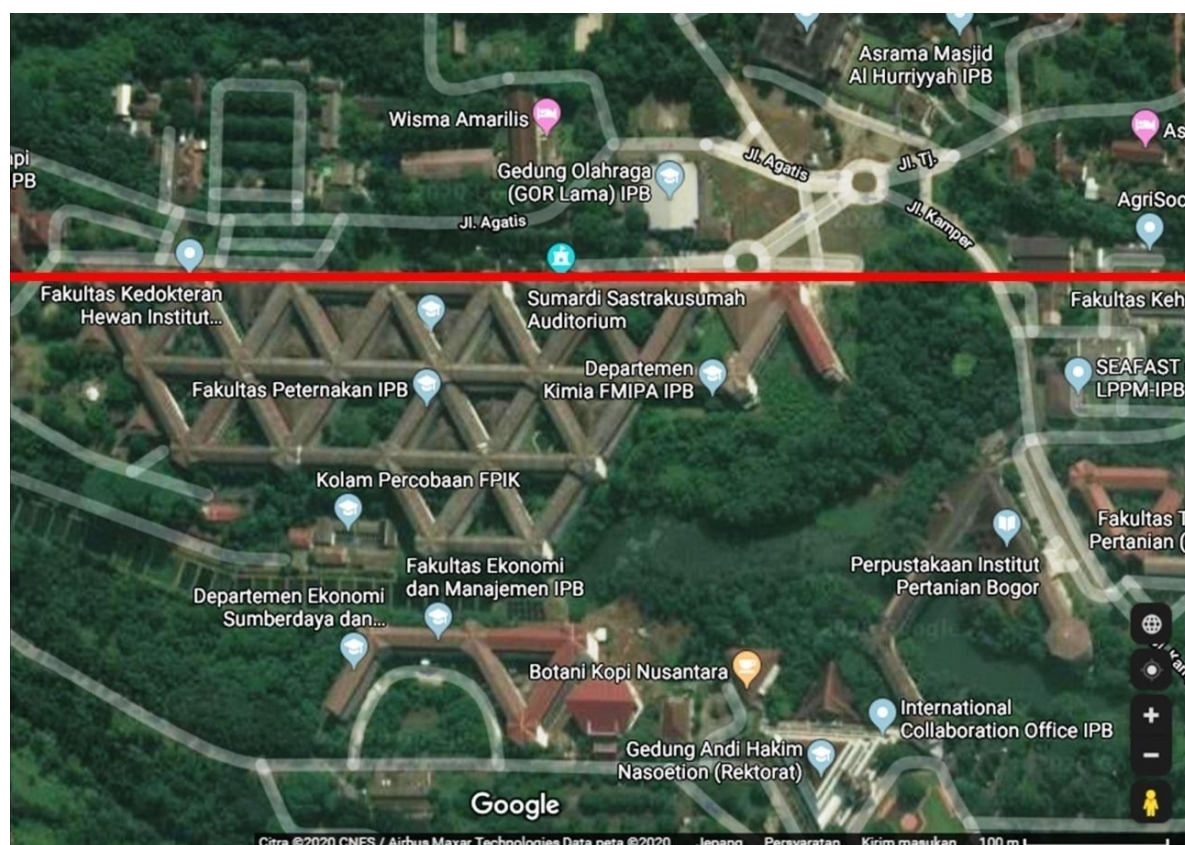


Figure 2 Sampling site (red line) of macroscopic fungi around IPB University Campus Building.



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

### ***Marasmiellus* sp.**

*Marasmiellus* sp. grow in groups, but the distance between fruit body was scattered on rotten twigs. (Figure 3.A). The pileus colour is white, and changed after time (hygrophanous), especially in the margin cap to reddish brown. Cap diameter is 9-12 mm with the conical shape at the young time and depressed at the mature stage. The surface of pileus coated floccose to pulverulent (powdery) (Figure 3.B), the edges are crisped, margins are slightly curved upturned, and moist at wetness level. This mushroom has hymenophore lamella (Figure 3.C) type with free lamellar attachment type, the medium distance between lines with a smooth margin. Stipe is cylindric-elongated form, 0.8 mm in diameter, 18-24 mm in length, and scaly surface. The stipe attaches to the center of the cap with solid flesh of stipe. There are no partial veils and soft fleshy fruit body texture. Fruit body texture is smooth with smells of soil and flavorless. *Marasmiellus* has been reported as source of hirsutane sesquiterpenes (Isaka *et al.*, 2016), laccase (Chenthamarakshan *et al.*, 2017), pathogen on *Elais gueneensis* (Almaliky *et al.*, 2012), and important decomposer in many forests in Indonesia (Retnowati, 2018).

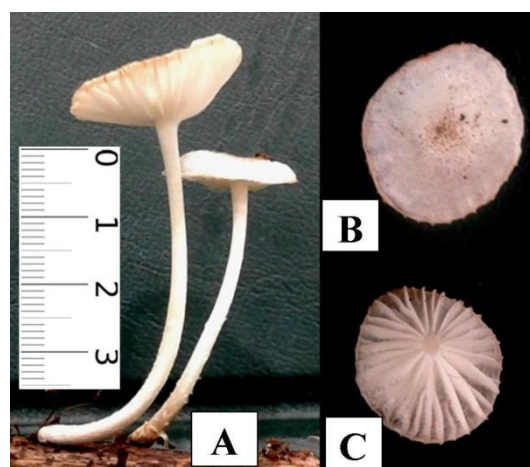


Figure 3 Characteristics of macroscopic identification of *Marasmiellus* sp.

### ***Pluteus* sp.**

*Pluteus* sp.1 grow solitary on loose soil with the brownish-colored hood (cap). The pileus color is light brown (Figure 4.A) and changed after the time (hygrophanous). Cap diameter is 2 cm with a depressed to a flat shape. The surface of the hood is radially fibrillose, crisped edges, inrolled margin, and moist at wetness level. The hymenophore is lamella with a freetype (Figure 4.B), dense in rows, purple-brown in color, and eroded at the margin. The stipe is cylindric, 3 mm in diameter, 5 cm in length, and smooth at the surface. The stipe attaches to the center of the cap with solid flesh of stipe. There are no partial veils and has soft fleshy fruit body texture. Fruit body texture is smooth with smells of wood, and flavorless. There are only a few reports found on the utilization of *Pluteus*. One comprehensive report is the potential to affect human health as allergens (Rivera-Mariani *et al.*, 2013). Putra *et al.*, (2018) also described another species of *Pluteus* sp. from Mekarsari Tourism Park.

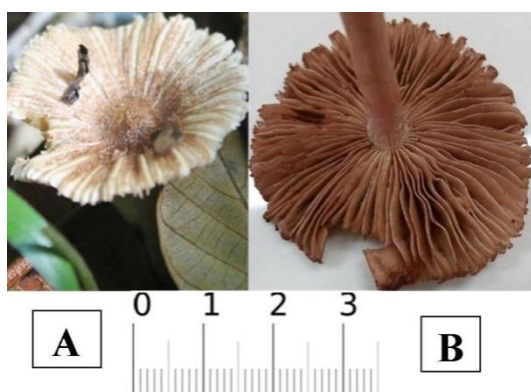


Figure 4 Characteristics of macroscopic identification of *Pluteus* sp.

### *Mycena* sp.

*Mycena* sp. found grow in wood with caespitose pattern, the fungus grows on wood (Figure 5.A). The pileus colour is light pink to orange without changing over time. Cap with a diameter of 1.4 cm, in the form of arched to semiglobose, and round shape from the bottom view. The cap surface is smooth, undulated edge, plane margin, and moist in wetness level. The hymenophore type is lamella (Figure 5.B), 0.7 cm in diameter, medium rows, and crenate type of margin. The stipe are : white in colour, 0.2 cm in diameter, 2.3 cm in length, hollow in cross-section. This mushroom has fleshy fruit body texture and does not possess a distinctive smell or taste. *Mycena* reported as alkaloid source (Lohmann *et al.*, 2018) and manganese source (Doddall *et al.*, 2014).



Figure 5 Characteristics of macroscopic identification of *Mycena* sp.

### *Agrocybe* sp.

*Agrocybe* sp. grows solitary on the ground (Figure 6.A). Pileus is predominantly brown, with no color changes over time (hygrophanous). The diameter of the cap (cap) is 1.4 cm, flat shape with umbo (Figure 6.B), and ovoid at the underside. Cap surface is scaly and slightly curved to the semi-uplifted margin. Hymenophore type is lamella (Figure 6.C) with free attachment type, 5.4 cm in length, medium rows, and entire type margin. Stipe are : smooth on the surface, 12.5 cm in length, 1.5 cm in diameter, and attached to the center of the pileus. Stipe is cylindrical with a hollow cross-section. Stipe color is light brown, modified with annulus at the semi-superior position, and attached to the substrate with basal tomentum type. *Agrocybe* sp. observed has fleshy fruit body texture and bitter taste. *Agrocybe* reported as a source of fucogalactan, which is considered a promising approach to the leishmaniasis treatment (Motoshima *et al.*, 2018), Anti-angiogenic activity (Lin *et al.*, 2017), and potential for degrading both low and high molecular weight polycyclic aromatic hydrocarbons (Chupungars *et al.*, 2009).

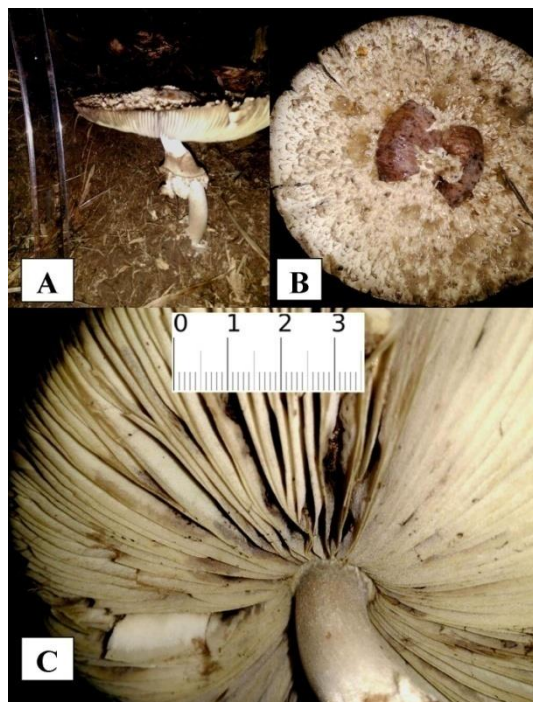


Figure 6 Characteristics of macroscopic identification of *Agrocybe* sp.

### *Polyporus* sp.

*Polyporus* sp. grows on wood with scattered style. The pileus is brown and color changed over time (Hygrophanous) to dark brown. Pileus diameter is 1.4 cm with flat shape and slightly decurrent at the middle part of the cap. The pileus surface is floccose with hairy edges (Figure 7.A). The margin is incurved with dry wetness levels. Hymenophore type is pore (Figure 7.B), detachable, and 0.1 cm in length. Stipe length is 1.6 cm, 0.1 cm in diameter, smooth surface, solid cross-section, and inserted type of stipe attachment to the substrate. The fruit body texture is soft, odorless, and flavorless. *Polyporus* found in this study is closely related to *Polyporus tricholoma*, but further observation is needed. *Polyporus* genus is reported as a source of secondary metabolites,

which are of medicinal interest as antibacterial compounds (Sun & Zhou, 2014; Liu *et al.*, 2018).



Figure 7 Characteristics of macroscopic identification of *Polyporus* sp.

### *Entoloma* sp.

The *Entoloma* sp. is found to grow in caespitose pattern. Pileus is brown without changing color after the time (Figure 8.A), as well as cap shape form in different stages. The surface of pileus is smooth, entire edge, inrolled margin, and dry of wetness level. The hymenophore is lamella with adnexed type at the cap attachment (figure 8.B) and crowded of rows of the lamella. Stipe is cylindrical, poses the same color with pileus, 9 mm in diameter, and smooth surface. The stipe attaches to the pileus in the center part with the hollow stipe section. The fruit body has a soft texture and does not have a unique characteristic odor. *Entoloma* reported for immunoenhancing and antioxidant activities (Maity *et al.*, 2014; Maity *et al.*, 2015).



Figure 8 Characteristics of macroscopic identification of *Entoloma* sp.

### ***Xeromphalina* sp.**

The *Xeromphalina* sp. found grow scattered in IPBUCB. Pileus is yellow to brownish-yellow, the color changed after the time (hygrophanous). Cap is flat, 40 mm in diameter, and decurrent at the center of pileus (Figure 9.A). The pileus surface is radially fibrillose, entire edges, plane margin, and dry wetness level. Lamella (Figure 9.B) length is 27 mm, crowded at rows, and entire margin. Stipe has the same diameter from the base to the pileus, 3 mm in diameter, 73 mm in length, and fibrillose surface. Stipe has a rhizoid type of attachment to the substrate, and hollow cross section. This mushroom has soft fruit body texture and bitter taste. Osivand *et al.*, (2018) reported that *Xeromphalina tenuipes* has allelopathic activity.



Figure 9 Characteristics of macroscopic identification of *Xeromphalina* sp.

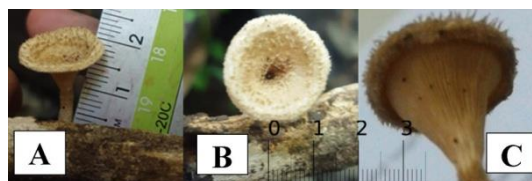


Figure 10 Characteristics of macroscopic identification of *Paxillus* sp.

### ***Paxillus* sp.**

The *Paxillus* sp. found to grow solitary on wood (Figure 10.A). Pileus is decurrent (Figure 10.B), hairy, brown color, and changing color after time. Pileus diameter is 1 cm with a concave shape, crisped edge, and rolled margin. The hymenophore is lamella with deeply decurrent and almost half of the stipe covered. Lamella length is 1 cm, crowded at rows, and serrulate margin. The stipe is pale brownish in colour, 0.5 cm in diameter, and 1.3 cm in length (Figure 10.C). The cylindrical stipe surface is fibrillose with an inserted type of substrate attachment. Stipe cross-section is stuffed, the texture of the fruit body is fleshy, and has wood smell and bitter or bitter taste. Colak *et al.*, (2018) reported that *Paxillus involutus* had antioxidant potential, and thus, medical properties.

### ***Lentinus* sp.1**

The collected *Lentinus* sp. live on dead trees in a scattered group type. The fruitbody consists of a depressed cup and a short stipe. Pileus is light brown, 8 cm in diameter, and flabelliform shape at the underside (Figure 11.A). The cap surface is radially fibrillose, crisped edge, uplifted margin, dry wetness level. The hymenophore type is lamella (Figure 11.B), 5.5 cm in diameter, serrulate margin. The stipe is brownish white, 1.8 cm in length, 1 cm in diameter, and has fibrillose surface. The stipe attaches to pileus on terminal position, inserted type to the substrate, and solid in cross-section. The mushroom has a fleshy flesh and flavorless.





Figure 11 Characteristics of macroscopic identification of *Lentinus* sp.1.

### *Lentinus* sp. 2

The *Lentinus* sp.2 found to grow scattered on the fallen trees (Figure 12.A). Pileus is orange to brown in color, 5-6 cm in diameter, radially fibrillose on the surfaces, undulating edge, (Figure 3), incurved margin, and dry level of wetness. The hymenophore is lamella (Figure 12.B) with deep decurrent type, 3.5 cm in length, crowded rows, incurved margin, and dry of wetness level. The pseudo stipe is cylindric in shape, 5mm in length, fibrillose surface, and solid cross-section. The fruit body has tough fleshy -texture and has a distinctive odor.

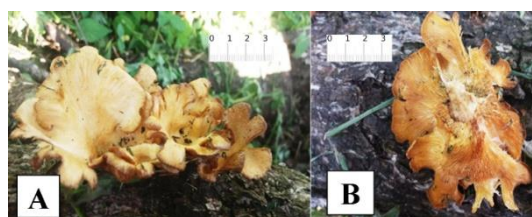


Figure 12 Characteristics of macroscopic identification of *Lentinus* sp.2



Figure 13 Characteristics of macroscopic identification of *Collybia* sp.

*Lentinus* is reported as a culinary-medicinal mushroom that possesses nutritious substances and biological activities (Lee *et al.*, 2013; Mohammadnejad *et al.*, 2019). Both *Lentinus* found in this study were different in colour and size with (Putra *et al.*, 2019b; Putra, 2020a).

### *Collybia* sp.

The *Collybia* sp. found to grow solitary (Figure 13.A) in semi forest soil near IPBUCB. Pileus are white in color, 32 mm in diameter, convex form from both top and bottom view. The surface pileus is smooth, flat edge, incurved margin, and dry at wetness level. The hymenophore is lamella with an adnexed type of attachment to the stipe and medium rows (Figure 13.B). The stipe is yellowish to white in colour, 5 mm in diameter, 50 mm in length, smooth surface, stuffed cross-section, and tapered downward. There are no partial veils and universal veils on the stipe. This mushroom has soft and fleshy fruit body texture and smells like vegetables. *Collybia* has been reported for antipruritic activity (Gupta *et al.*, 2016) and the source of antibiotics (Engler *et al.*, 1998).

### *Parasola* sp.

The *Parasola* sp. found to live in the soil between grasses. Pileus is dark brown at the edge and pale brown at the center (Figure 14.A). Cap is radially fibrillose surface, 3-4 cm in diameter, convex in shape, wavy edge, inrolled margin, and moist in wetness level (Figure 14.B). The hymenophore is lamella type (Figure 14.C), 1.5 cm in length, dense rows, and undulate margin. Stipe is

cylindric in shape, white in color, 0.5 cm in diameter, 6 cm in length, and smooth at the surface. The fruit body is soft and has flavorless taste. Sandargo *et al.*, (2019) reported that many Basidiomycota, including *Parasola* are an important source of new pharmaceuticals and agrochemicals in the near future.

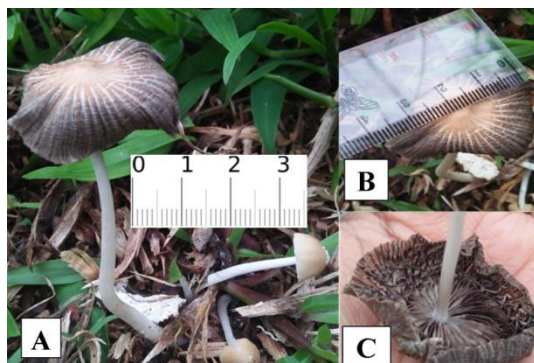


Figure 14 Characteristics of macroscopic identification of *Parasola* sp.

## CONCLUSION

A total of 13 mushrooms were identified and described in this study, namely: *Armillariella* sp., *Marasmiellus* sp., *Mycena* sp., *Agrocybes* p., *Polyporus* sp., *Entoloma* sp., *Xeromphalina* sp., *Paxillus* sp., *Lentinus* sp. 1, *Lentinus* sp. 2, *Collybia* sp., *Pluteus* sp., and *Parasola* sp. Some macroscopic fungi found to be potentially used as bioactive compound source, medicine, and also played an important role as a decomposer in the IPBUCB.

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