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**Research Article**

# Inventory of Macrofungi in Area of Taman Hutan Raya (TAHURA) Ir. H. Djuanda Bandung

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## ABSTRACT

Taman Hutan Raya (TAHURA) Ir. H. Djuanda Bandung is an integrated conservation area in which there are secondary natural forests that have various kinds of flora and fauna. Macrofungi are fungi whose fruiting bodies can be seen directly without the aid of a microscope, heterotrophic, and ecologically act as decomposers of organic matter (decomposers) and as biological control agents. Data related to research results on macrofungi in the Tahura area is still limited and need more comprehensive research. This study aimed to inventory, determine the growth factors, and potential utilization of macroscopic fungi. Observations were carried out during the period of November 2021 - April 2022 using exploration method. Sampling was done by purposive sampling method. Macrofungi identification process was carried out based on morphological characters such as cap, stalk, and lamella, The environmental factors observed included air humidity, soil pH, temperature, and type of substrate. The results showed that as many as 83 species were found in the Protection block, 50 species were found in the Collection block, and 99 species were identified in the Utilization block from the phyla Basidiomycota and Ascomycota. The macrofungi found have potential as biodegradation agents, food ingredients, non-food ingredients, drugs, antimicrobials, antioxidants, anticancer, and anti-inflammatory.



## INTRODUCTION

Indonesia is known as a country with abundant biodiversity or more known as a mega-biodiversity country. This is because Indonesia's tropical climate makes it suitable as a habitat for various living things, both flora and fauna (Nur et al. 2021). Forests whose natural level is still maintained and have diverse and varied ecosystem components. Biological components that play an important role and have not been fully utilized properly are decomposers, for example, fungi. Fungi that benefits the ecosystem are macrofungi (Kinge et al. 2017).

Macrofungi are fungi whose fruiting bodies can be seen directly, without the aid of a microscope. Most are from the division Basidiomycota, Ascomycota, and some are from the division Zygomycota (Mueller et al. 2007). Macrofungi play an important role in forest ecosystems (Suharno et al. 2018). From the ecological perspective, macrofungi act as decomposers and biological controllers by supporting biogeochemical cycles (Arini et al. 2019). Macrofungi are one of the biological components that are present in all types of ecosystems. Macrofungi are widely spread because their large spores are easy to spread (Proborini 2012).

Taman Hutan Raya (TAHURA) Ir. H. Djuanda Bandung is a secondary natural forest area and has quite various flora with an area of approximately 546.28 ha which is divided into three blocks namely the Protection block, Utilization block, and Collection block and two areas which stretches between Maribaya and Pakar areas. TAHURA Bandung is located in the north of Bandung City, more precisely in Kampung Pakar, Ciburial Village, Cimenyan District, Bandung, West Java. The forest type in this area is mixed vegetation forest where there are approximately 40 families and 112 plant species (Ihsan 2012). From these data, there are several types of higher plants, including pine, resin, cinnamon, banyan, cypress, kigelia, and also Rafflesia flower. Different geographical conditions in the TAHURA Ir. H. Djuanda Bandung cause many unidentified macrofungi.

Studies of macrofungi in the TAHURA Ir. H. Djuanda Bandung have not much been done. The activities carried out can determine the macroscopic mushrooms potential and classify toxic and non-toxic mushrooms. In addition, some people do not know the role of mushrooms as one of the biodiversity which is very rich in benefits, including being used as food, industry, health, cosmetics and their role in the environment. Besides that, the big role that mushrooms have will help in efforts to manage conservation and control the life cycle of an ecosystem in one area sustainably (Prasetyo et al. 2009).

## MATERIALS AND METHODS

Field research was carried out using the exploration method in three blocks of TAHURA Ir. H. Djuanda which included the blocks of Protection, Collection, and Utilization (Figure 1). Sampling was carried out twice with the range time from November 2021 to April 2022. The samples found from the searching results were then preserved in wet or dry conditions and identified until the species stage. The results of the preservation that had been made were then stored in the Laboratory of Universitas Islam Negeri Sunan Gunung Djati Bandung as collections.

The research was carried out in a descriptive exploratory method in which the activities of this research included collecting specimens, identifying, classifying, describing, and inventorying samples of the macrofungi found. The sampling technique used was purposive sampling, namely a sampling technique by determining certain criteria (Mukhsin et al. 2017). According to Arikunto (2003), the method is also called a data collection method which is not specific to a particular area but focuses on the purpose of the data collection process itself. Sampling with this method was used to collect species and the data were analyzed descriptively.

Identification of macrofungi was carried out based on morphological characters of the cap (pileus), gills (lamella), and stalk (stipe), as well as other characteristics of the fruiting body. The data obtained was then matched with macrofungi identification books (Moore & Sullivan 2013), the Mycokey 4.1 application, and the Book on Macrofungi (Smith et al. 1988). Additionally, the identification process is aided by mushroom experts, field guides, and local communities. During field observations and mushroom tracking, data collection also involves recording abiotic factors or environmental conditions including altitude,

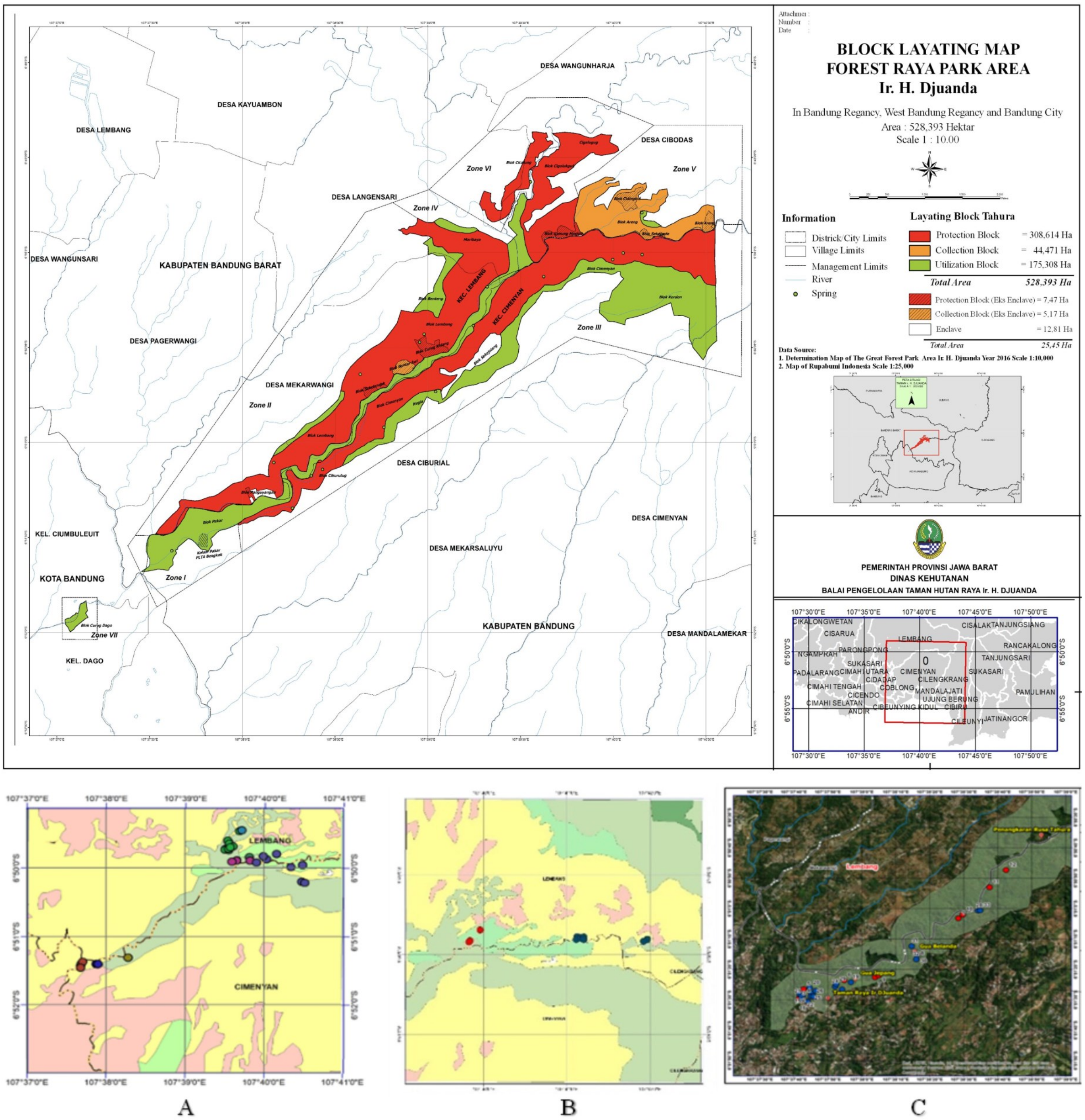


**Figure 1.** Location of TAHURA Ir. H. Djuanda Bandung (A= blocks of Protection, B= blocks of Collection, and C= blocks of Utilization

coordinate positions, measurement of environmental factors such as soil pH (using a soil tester), air humidity and temperature (using a thermo-hygrometer), and mushroom habitat.

## RESULTS AND DISCUSSION

### Types of Macrofungi

Based on the exploration results, 83 macrofungi species were found in the Protection block (Table 1), 50 in the Collection block (table 2), and 99 in the Utilization block (Table 3). In the Protection block, 83 macrofungi species were identified across two divisions, nine orders, and 29 families. November 2021 sampling discovered 40 species (22 in Tonjong Sawah, 9 in Cibingkul, 8 in Pakar (1), and 1 in Goa Belanda), while February 2022 sampling found 57 species (25 in Cibodas, 10 in Gunung Masigit, 10 in Seke Gede, and 12 in Pakar 2). Agaricales, with 15 families, dominated the Protection block, showing high adaptability. Polyporaceae family dominated the macrofungi in the Pakar (2) route due to the abundance of rotted wood in TAHURA, attributed to the order Polyporales, known for its various fruiting body shapes, colours, and sizes, particularly in the genus Ganoderma.

Based on Table 2 (attachment), the Collection block harbou red 50 macrofungi species across all lines (*comprising two divisions, eight orders and twenty three families*), with 56 species from Basidiomycota and only one from Ascomycota. November 2021 sampling yielded 23 species (across eighteen families and two divisions), with 15 species in the Percoba Areng line. Basidiomycota dominated with ten families, while Ascomycota had one order, Xylariales. Gunung Masigit line had eight Basidiomycota species across seven families. January 2022 sampling found 34 species (across eighteen families and one division, Basidiomycota), with 26 species in the Percoba Areng line and eight in the Gunung Masigit line. The Collection block was dominated by Basidiomycota, particularly the Polyporaceae family, with 11 species. According to Khastini et al. (2019) the Polyporaceae family has good adaptability in various places at different altitudes with high humidity. Macrofungi collection during the rainy season (January) yielded higher numbers compared to the dry season (November). Macrofungi occurrence and diversity are greatly influenced by vegetation, geography, seasons, and succession stages. Optimal fruiting occurs in winter or the rainy season due to favourable humidity levels. Higher humidity in the rainy season promotes spore germination and growth. Macrofungi absorb nutrients from the environment through enzymatic breakdown of organic matter into simple molecules, which are then absorbed by hyphae.

Based on Table 3 (attachment), 99 macrofungi species were found in the Utilization block during January and April 2022. In January, 63 species were discovered, with Basidiomycota dominating (eight orders, 23 families), while Ascomycota had five species from two orders and three families. Agaricaceae was the most common family with 12 species. Macrofungi sampling in April found 24 species with Basidiomycota more prevalent. Polyporaceae was the most common family with 11 species.

The Utilization block's dense canopy provided stable temperatures, allowing macrofungi growth even in the dry season. Its proximity to a tourist route led to the discovery of macrofungi mainly from Agaricaceae and Polyporaceae families due to inorganic waste promoting their growth. Macrofungi depend on weathering wood for nutrients, thriving in places rich in carbohydrates, cellulose, and lignin, like leaf litter, tree branches, and rotted wood (Annissa et al. 2017)**.** Some fungi are difficult to identify to the species level because some fungal samples are found in damaged conditions.

The Russulales order is an order that belongs to the class Agaricomycetes, according to Kirk et al. (2008), the order consists of 13 families and there are at least 3,060 species found. This order was previously included in the order Agaricales, but currently the order Russulales is a unitary order of several families that have different characters from the order Agaricales (Mishra 2005). Most Russulales have a cap that is convex to funnel-shaped above a stipe or stalk with no ring or volva. Some genera, such as Russula and *Lactarius*, do not have flexible fruit flesh, so when handled it is very brittle like soft chalk (Mishra 2005). The difference from each genus found is that the *Lactarius* genus has a fruiting body covered by latex while the Russula does not, even though their shape is similar. Meanwhile, *Sterum* has no stalks but hard fruiting bodies.

The order Geastrales has hygroscopic fruiting bodies where in dry weather the calyx-shaped parts of the fungus dry and curl around the soft spore sac to protect it. In this state, often the entire mushroom is

**Table 1.** Macrofungi found in the protection line/block.

| No | Species | Genus | Family | Ordo | Line | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | TS | CB | PK1 | GB | CBD | GM | SG | PK2 |
| 1 | *Agaricus augustus* Fr. | *Agaricus* | Agaricacea | Agaricales | √ | - | - | - | - | - | - | - |
| 2 | *Agaricus* cf *trisulphuratu* Berk. | *Agaricus* | Agaricacea | Agaricales | - | - | √ | - | - | - | - | - |
| 3 | *Agaricus silvicola* var. silvicola (Vittad.) Peck | *Agaricus* | Agaricacea | Agaricales | √ | √ | - | - | - | - | - | - |
| 4 | *Agaricus subrutilescens* (Kauffman) Hotson & D.E. Stuntz, (1938) | *Agaricus* | Agaricacea | Agaricales | √ | - | - | - | - | - | - | - |
| 5 | *Amanita* cf. *hemibapha (Berk. & Broome) Sacc.* | *Amanita* | Amanitaceae | Agaricales | √ | - | - | - | - | - | - | - |
| 6 | *Amanita sect. lepidella* | *Amanita* | Amanitaceae | Agaricales | - | - | - | - | √ | - | - | - |
| 7 | *Amanita sect. vaginata (Bull. : Fr.) Vittadini* | *Amanita* | Amanitaceae | Agaricales | - | - | √ | - | - | - | - | - |
| 8 | *Amauroderma rugosum* (Blume & TNees) Torrend | *Amauroderma* | Ganodermataceae | Polyporales | - | - | - | - | - | - | - | √ |
| 9 | *Auricularia auricula-judae* (Bull.: Fr.) Wettstein | *Auricularia* | Auriculariaceae | Auricurales | - | - | - | - | √ | √ | - | - |
| 10 | *Auricularia delicata* (Mont. ex Fr.) Henn. | *Auricularia* | Auriculariaceae | Auricurales | - | - | - | - | √ | √ | - | - |
| 11 | *Baespora mysosura* Singer | *Baespora* | Marasmiaceae | Agaricales | - | - | - | - | - | - | √ | - |
| 12 | *Bovista plumbea* Pers. | *Bovista* | Agaricacea | Agaricales | √ | - | - | - | - | - | - | - |
| 13 | *Calvatia cyathiformis (Bosc) Morgan, J.* | *Calvatia* | Agaricacea | Agaricales | √ | - | - | - | - | - | - | - |
| 14 | *Calvatia rugosa* (Berk. & M.A..Curtis) D.A. Reid | *Calvatia* | Agaricacea | Agaricales | √ | - | - | - | - | - | - | - |
| 15 | *Candolleomyces eurysporus* | *Candolleomyces* | Crepidotaceae | Agaricales | - | - | - | - | √ | - | - | - |
| 16 | *Collybia eucalyptorum* Cleland | *Collybia* | Tricholomataceae | Agaricales | - | - | - | - | √ | - | - | - |
| 17 | *Coprinellus curtus* (Kalchbr.) Vilgalys, Hopple & Jacq.Johnson | *Coprinellus* | Psathyrellaceae | Agaricales | - | - | - | - | √ | √ | - | - |
| 18 | *Coprinopsis sec. atrsmentaria* (Bull.) | *Coprinopsis* | Psathyrellaceae | Agaricales | √ | - | - | - | - | - | - | - |
| 19 | *Coprinopsis sect invei* | *Coprinopsis* | Psathyrellaceae | Agaricales | √ | - | - | - | - | - | - | - |
| 20 | *Crepidotus applanatus* (Pers.) Kummer | *Crepidotus* | Crepidotaceae | Agaricales | - | - | - | - | √ | - | - | - |
| 21 | *Crepidotus variabilis* (Pers.: Fr.) Kumme | *Crepidotus* | Crepidotaceae | Agaricales | - | - | - | - | √ | - | - | - |
| 22 | *Cymatoderma* cf. *elegans* Jungh. | *Cymatoderma* | Meruliaceae | Polyporales | - | - | - | - | - | - | - | √ |
| 23 | *Dacryopinax spathularia* (Schwein.) G.W. Martin | *Dacryopinax* | Dacrymycetaceae | Dacrymycetales | - | √ | - | - | - | - | - | - |
| 24 | *Filoboletus manipularis* (Berk.) Teng | *Filoboletus* | Mycenaceae | Agaricales | - | - | - | - | - | - | - | √ |
| 25 | *Favolus tenuiculus* P. Beauv. | *Favolus* | Polyporaceae | Polyporales | - | - | - | - | - | - | - | √ |
| 26 | *Fistulina hepatica* (J.C. Sch. Fr.) Withering | *Fistulina* | Fistulinaceae | Agaricales | √ | - | - | - | - | - | - | - |
| 27 | *Ganoderma applanatum* (Pers.) Pat. | *Ganoderma* | Ganodermataceae | Polyporales | - | - | √ | - | - | - | - | √ |
| 28 | *Geastrum fimbriatum* Fr. | *Geastrum* | Geastraceae | Geastrales | - | - | - | - | √ | - | - | - |
| 29 | *Geastrum sessile* (Sow.) Pouzar | *Geastrum* | Geastraceae | Geastrales | - | - | - | - | - | √ | - | - |
| 30 | *Geastrum triplex* Junghuhn | *Geastrum* | Geastraceae | Geastrales | - | - | - | - | √ | - | - | - |
| 31 | *Gymnopilus sapineus (Fr.: Fr.) Murrill* | *Gymnopilus* | Cortinariaceae | Agaricales | - | - | - | - | - | - | √ | - |
| 32 | *Gymnopus dichrous* (Berk. & M. A Curtis) Halling | *Gymnopus* | Omphallotaceae | Agaricales | √ | - | - | - | - | - | - | - |
| 33 | *Gymnopus dryophilus* (Bull.) Murrill | *Gymnopus* | Omphallotaceae | Agaricales | - | √ | - | - | - | - | - | - |
| 34 | *Heterobasidion annosum* (Fr Fr.) Brefeld | *Heterobasidion* | Bondarwiaceae | Russulales | - | - | √ | - | - | - | - | - |
| 35 | *Heterobasidion* cf. *parviporum*Niemelä & Korhone | *Heterobasidion* | Bondarwiaceae | Russulales | - | - | - | - | - | - | √ | - |
| 36 | *Hexagonia tenuis* (Fr.) Fr. | *Hexagonia* | Polyoraceae | Polyporales | - | - | - | - | √ | - | - | - |
| 37 | *Inocybe cincinnata* (Fr.) Quélet | *Inocybe* | Inocybaceae | Agaricales | - | - | - | - | - | - | √ | - |
| 38 | *Laccaria laccata* (Scop. Fr.) Cooke | *Laccaria* | Hydnagiaceae | Agaricales | √ | - | - | - | - | - | - | - |
| 39 | *Lactarius* cf. *rubidus* (Hesler & A.H.Sm.) Methven | *Lactarius* | Russulaceae | Russulales | - | - | - | - | √ | - | - | - |
| 40 | *Lactarius quieticolor* Romagnesi | *Lactarius* | Russulaceae | Russulales | - | √ | - | - | | - | - | - |
| 41 | *Lamicella glischra* (Morgan) Murril | *Lamicella* | Amanitaceae | Agaricales | √ | - | - | - | | - | - | - |

**Table 1.** Contd.

| No | Species | Genus | Family | Ordo | Line | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | TS | CB | PK1 | GB | CBD | GM | SG | PK2 |
| **42** | *Lentinus arcularius* (Batsch: Fr.) Fr. | *Lentinus* | Polyporaceae | Polyporales | √ | - | - | - | √ | - | - | √ |
| **43** | *Lentinus sajor-caju* (Fr.) Fr. | *Lentinus* | Polyporaceae | Polyporales | √ | - | - | - | | - | - | √ |
| **44** | *Lentinus tricholoma* (Mont.) Zmitr. | *Lentinus* | Polyporaceae | Polyporales | - | - | - | - | √ | - | - | - |
| **45** | *Lepiota Castanea* | *Lepiota* | Agaricaceae | Agaricales | - | - | - | - | √ | - | - | - |
| **46** | *LeucoAgaricus croceovelutinus* (M. Bon & Boiffard) M. Bon & Boiffard | *LeucoAgaricus* | Agaricaceae | Agaricales | - | - | - | - | - | - | - | √ |
| **47** | *Leucocoprinus fragilissimus* (Ravenel) Pat. | *Leucocoprinus* | Agaricaceae | Agaricales | √ | - | - | - | - | - | - | - |
| **48** | *Lycoperdon perlatum* Pers. | *Lycoperdon* | Agaricaceae | Agaricales | - | √ | - | - | - | - | - | - |
| **49** | *Lycoperdon umbrinum* Persoon | *Lycoperdon* | Agaricaceae | Agaricales | √ | - | - | - | - | - | - | - |
| **50** | *Marasmiellus candidus* (Bolt.) Singer | *Marasmiellus* | Marasmieceae | Agaricales | - | - | - | - | √ | √ | - | - |
| **51** | *Marasmiellus villosipes* (Cleland)J. S OLiveira | *Marasmiellus* | Marasmiaceae | Agaricales | - | √ | - | - | - | - | - | - |
| **52** | *Marasmius calhouniae S*inger | *Marasmius* | Marasmiaceae | Agaricales | - | - | - | √ | - | - | - | - |
| **53** | *Microporus* cf.*affinis* (Blume & T.Nees) Kuntze | *Microporus* | Polyporaceae | Polyporales | - | - | - | - | √ | - | - | - |
| **54** | *Mycena capillaripes* Peck | *Mycena* | Mycenaceae | Agaricales | √ | - | - | - | - | √ | - | - |
| **55** | *Mycena* cf. *hiemalis* (Osbeck) Quélet | *Mycena* | Mycenaceae | Agaricales | √ | - | - | - | - | - | - | - |
| **56** | *Mycena galericulata* var. albida (Pers.) Gillet | *Mycena* | Mycenaceae | Agaricales | - | - | - | - | - | √ | - | - |
| **57** | *Mycena holoporphyra* (Berl. & M. A. Cutis) Singer | *Mycena* | Mycenaceae | Agaricales | √ | - | - | - | - | - | - | - |
| **58** | *Mycena leptocephala* (Pers. : Fr.) Gillet | *Mycena* | Mycenaceae | Agaricales | - | - | - | - | √ | - | - | - |
| **59** | *Mycena stylobates* (Pers. : Fr.) Kummer | *Mycena* | Mycenaceae | Agaricales | - | - | - | - | - | √ | - | - |
| **60** | *Nigroporus vinosus* (Berk.) Murrill | *Nigroporus* | Polyporaceae | Polyporales | - | - | - | - | - | - | √ | - |
| **61** | *Oudemansiella canarii* (Jungh.) Hohn. | *Oudemansiella* | Physalacriaceae | Agaricales | - | - | - | - | - | - | - | √ |
| **62** | *Parasola plicatilis* (Curt. : Fr.) Fr. | *Parasola* | Psathyrellaceae | Agaricales | - | - | - | - | √ | - | - | |
| **63** | *Phillipsia domingensis Berk.* | *Phillipsia* | Sarcoscyaceae | Pezizales | - | - | √ | - | - | - | | √- |
| **64** | *Pleurotus aff.djamor* (Rumph. Ex Fr.) Boedijn | *Pleurotus* | Pleurotacaee | Agaricales | - | - | - | - | √ | - | - | - |
| **65** | *Polyporus grammocephalus* Berk. | *Polyporus* | Polyporaceae | Agaricales | √ | - | - | - | - | - | - | - |
| **66** | *Psathyrella bipellis (Quélet) A.H. Smith* | *Psathyrella* | Psathyrellaceae | Agaricales | - | - | - | - | √ | - | - | - |
| **67** | *Psathyrella corrugis* (Pers. : Fr.) Konrad & Maublanc | *Psathyrella* | Psathyrellaceae | Agaricales | - | - | - | - | - | - | √ | - |
| **68** | *Pseudomerulius curtisii* (Berk.) Redhead & Ginns | *Pseudomerulius* | Tapinellaceae | Boletales | - | - | - | - | - | - | √ | - |
| **69** | *Ramariopsis kunzei* (Fr. : Fr.) Corner | *Ramariopsis* | Clavariaceae | Agaricales | - | - | | - | - | - | √ | - |
| **70** | *Russula emetica* (J.C. Sch. : Fr.) Pers. | *Russula.* | Russulaceae | Russulales | - | - | √ | - | √ | √ | - | - |
| **71** | *Russula zonatula* Ebbesen & Jul. Schaff | *Russula* | Russulaceae | Russulales | √ | - | - | - | - | - | - | - |
| **72** | *Scutellinia aff. Scutellata* (L.) Lambote | *Scutellinia* | Pyronemataceae | Pezizales | - | - | - | - | √ | - | - | - |
| **73** | *Stereum* cf.*hirsutum* (Willdenow : Fr.) S.F. Gray | *Stereum* | Stereceae | Russulales | - | - | √ | - | - | - | - | - |
| **74** | *Stereum ostrea* (Blume & T.Nees) Fr. | *Stereum* | Stereceae | Russulales | - | - | - | - | - | - | - | √ |
| **75** | *Suillus bovinus* (L. : Fr.) Roussel | *Suillus* | Suillaceae | Boletales | - | - | - | - | - | - | √ | - |
| **76** | *Suillus granulatus* (L. : Fr.) Roussel | *Suillus* | Suillaceae | Boletales | - | - | - | - | - | - | √ | - |
| **77** | *Suillus placidus* (Bonord.) Singer | *Suillus* | Suillaceae | Boletales | - | √ | - | - | - | - | - | - |
| **78** | *Suillus spraguei* (Berk. & M.A.Curtis) Kuntze | *Suillus* | Suillaceae | Boletales | - | - | √ | - | - | - | - | - |
| **79** | *Tapinella panuoides* (Fr. : Fr.) E.-J. Gilbert | *Tapinella* | Tapinella | Boletales | - | - | - | - | √ | - | - | - |
| **80** | *Trametes ochracea* (Pers.) Gilbertson & Ryvarden | *Trametes* | Polyporaceae | Polyporales | - | √ | - | - | √ | - | - | - |
| **81** | *Tricholoma sulphureum* (Bull. : Fr.) Kummer | *Tricholoma* | Tricolomataceae | Agaricales | - | √ | - | - | - | - | - | - |
| **82** | *Xylaria* sp. | *Xylaria* | Xylariaceae | Xylariales | - | - | - | - | √ | - | - | - |
| **83** | *Xylaria longipes Nitschke* | *Xylaria* | Xylariaceae | Xylariales | - | - | - | - | - | √ | - | √ |

Note: TS: Tonjong Sawah, CB: Cibingkul, PK1: Pakar 1, GB: Goa Belanda, CBD: Cibodas, GM: Gunung Masigit, SG: Seke Gede, PK2: Pakar 2

**Table 2.** Macrofungi found in the collection line/block.

| No | Species | Genus | Family | Ordo | Line | |
|---|---|---|---|---|---|---|
| | | | | | Percoba Areng | Gunung Masigit |
| 1 | *Xylaria* sp. | *Xylaria* | Xylariaceae | Xylariales | √ | - |
| 2 | *Mycena* sp.1 | *Mycena* | Mycenaceae | Agaricales | √ | - |
| 3 | *Mycena* sp.2 | *Mycena* | Mycenaceae | Agaricales | √ | - |
| 4 | *Mycena* sp.3 | *Mycena* | Mycenaceae | Agaricales | √ | - |
| 5 | *Favolaschia* sp.1 | *Favolaschia* | Mycenaceae | Agaricales | √ | √ |
| 6 | *Favolaschia* sp.2 | *Favolaschia* | Mycenaceae | Agaricales | √ | √ |
| 7 | *Marasmiellus* sp.1 | *Marasmiellus* | Marasmiaceae | Agaricales | √ | - |
| 8 | *Marasmiellus* sp.2 | *Marasmiellus* | Marasmiaceae | Agaricales | √ | - |
| 9 | *Marasmiellus* sp.3 | *Marasmiellus* | Marasmiaceae | Agaricales | √ | - |
| 10 | *Marasmiellus* sp.4 | *Marasmiellus* | Marasmiaceae | Agaricales | √ | - |
| 11 | *Gerronema* sp. | *Gerronema* . | Marasmiaceae | Agaricales | √ | - |
| 12 | *Hygrocybe* sp. | *Hygrocybe* | Hygrophoraceae | Agaricales | √ | √ |
| 13 | *Parasola* sp. | *Parasola* | Psathyrellaceae | Agaricales | √ | - |
| 14 | *Coprinellus* sp.1 | *Coprinellus* | Psathyrellaceae | Agaricales | √ | - |
| 15 | *Coprinellus* sp.2 | *Coprinellus* | Psathyrellaceae | Agaricales | √ | - |
| 16 | *Coprinellus* sp.3 | *Coprinellus* | Psathyrellaceae | Agaricales | √ | - |
| 17 | *Coprinellus* sp.4 | *Coprinellus* | Psathyrellaceae | Agaricales | - | √ |
| 18 | *Tricholomopsis* sp. | *Tricholomopsis* | Tricholomataceae | Agaricales | √ | - |
| 19 | *Oudemansiella* sp. | *Oudemansiella* | Physalacriaceae | Agaricales | √ | - |
| 20 | *Cyptotrama* sp. | *Cyptotrama* | Physalacriaceae | Agaricales | - | √ |
| 21 | *Schizophyllum commune* Fr. | *Schizophyllum* | Schizophyllaceae | Agaricales | √ | - |
| 22 | *Clavaria* sp. | *Clavaria* | Clavariaceae | Agaricales | √ | - |
| 23 | *Gymnopus* sp.1 | *Gymnopus* | Omphalotaceae | Agaricales | √ | - |
| 24 | *Gymnopus* sp.2 | *Gymnopus* | Omphalotaceae | Agaricales | - | √ |
| 25 | *Gymnopilus* sp. | *Gymnopilus* | Cortinariaceae | Agaricales | - | √ |
| 26 | *Lepista sordida* (Schumach.) Singer | *Lepista* | Tricholomataceae | Agaricales | - | √ |
| 27 | *Entoloma* sp. | *Entoloma* | Entolomaceae | Agaricales | - | √ |
| 28 | *Auricularia auricula-judae* (Bull.: Fr.) Wettstein | *Auricularia* | Auriculariaceae | Auriculariales | √ | √ |
| 29 | *Auricularia delicata* (Mont. Ex Fr.) Henn. | *Auricularia.* | Auriculariaceae | Auriculariales | √ | √ |
| 30 | *Microporus* sp. | *Microporus* | Polyporaceae | Polyporales | √ | √ |
| 31 | *Polyporus* sp.1 | *Polyporus* | Polyporaceae | Polyporales | √ | - |
| 32 | *Polyporus* sp.2 | *Polyporus* | Polyporaceae | Polyporales | √ | - |
| 33 | *Favolus* sp. | *Favolus* | Polyporaceae | Polyporales | √ | - |
| 34 | *Cerioporus* sp. | *Cerioporus* | Polyporaceae | Polyporales | √ | - |
| 35 | *Hexagonia* sp. | *Hexagonia* | Polyporaceae | Polyporales | √ | - |
| 36 | *Poria* sp. | *Poria* | Polyporaceae | Polyporales | - | √ |
| 37 | *Trametes* sp.1 | *Trametes* | Polyporaceae | Polyporales | - | √ |
| 38 | *Trametes* sp.2 | *Trametes* | Polyporaceae | Polyporales | - | √ |
| 39 | *Trametes* sp.3 | *Trametes* | Polyporaceae | Polyporales | - | √ |
| 40 | *Cymatoderma* sp. | *Cymatoderma* | Meruliaceae | Polyporales | √ | - |
| 41 | *Nigroporus* sp. | *Nigroporus* | Steccherinaceae | Polyporales | - | √ |
| 42 | *Rigidoporus* sp. | *Rigidoporus* | Meripilaceae | Polyporales | - | √ |
| 43 | *Russula* sp.1 | *Russula* | Russulaceae | Russulales | √ | √ |
| 44 | *Russula* sp.2 | *Russula* | Russulaceae | Russulales | √ | - |
| 45 | *Lactarius* sp. | *Lactarius* | Russulaceae | Russulales | - | √ |
| 46 | *Stereum* sp. | *Stereum* | Stereaceae | Russulales | √ | - |
| 47 | *Aseroe rubra* Labill. | *Aseroe* | Phallaceae | Phallales | - | √ |
| 48 | *Phallus indusiatus* Vent. | *Phallus* | Phallaceae | Phallales | - | √ |
| 49 | *Tremella* sp. | *Tremella* | Tremellaceae | Tremellales | √ | - |
| 50 | *Suillus* sp. | *Suillus* | Suillaceae | Boletales | √ | - |

**Table 3.** Macrofungi found in the Utilization line/block.

| No | Species | Genus | Family | Ordo | Line | |
|---|---|---|---|---|---|---|
| | | | | | Pakar | Maribaya |
| 1 | *Phillipsia* cf. *subpurpurea* Berk. & Broome | *Phillipsia* | Sarcoscyphaceae | Pezizales | - | √ |
| 2 | *Gymnopilus* sp. | *Gymnopilus* | Cortinariaceae | Agaricales | √ | - |
| 3 | *Irpex* sp. | *Irpex* | Meruliaceae | Polyporales | - | √ |
| 4 | *Meiorganum curtisii* (Berk.) Singer, J.García & L.D.Gómez | *Meiorganum* | Paxillaceae | Boletales | - | √ |
| 5 | *Inocybe* cf. *haemacta* (Berk. & Cooke) Sacc. | *Inocybe* | Inocybaceae | Agaricales | - | √ |
| 6 | *Conocybe* sp. | *Conocybe* | Bolbitiaceae | Agaricales | √ | √ |
| 7 | *Schizophyllum commune* Fr. | *Schizophyllum* | Scizophyllaceae | Agaricales | √ | - |
| 8 | *Pleurotus columbinus* Quél. | *Pleurotus* | Pleurotaceae | Agaricales | √ | - |
| 9 | *Candolleomyces* sp. | *Candolleomyces* | Psathyrellaceae | Agaricales | - | √ |
| 10 | *Auricularia polytricha* (Mont.) Sacc. | *Auricularia* | Auriculariaceae | Auricurales | - | √ |
| 11 | *Trogia* sp. | *Trogia* | Marasmiaceae | Agaricales | √ | - |
| 12 | *Ganoderma* cf.*lobatum* (Cooke) G.F.Atk | *Ganoderma* | Ganodermataceae | Polyporales | - | √ |
| 13 | *Tricholoma sulphureum* (Bull.) P.Kumm | *Tricholoma* | Tricholomataceae | Agaricales | √ | - |
| 14 | *Stereum* sp.1 | *Stereum* | Stereaceae | Russulales | - | √ |
| 15 | *Stereum* sp.2 | *Stereum* | Stereaceae | Russulales | √ | - |
| 16 | *Geastrum* cf. *saccatum* Fr. | *Geastrum* | Geastraceae | Geastrales | - | √ |
| 17 | *Geastrum hirsutum* Baseia & Calonge | *Geastrum* | Geastraceae | Geastrales | √ | - |
| 18 | *Agaricus* aff. *Mangaoensis* M.Q.He &R.L.Zhao | *Agaricus* | Agaricaeae | Agaricales | - | √ |
| 19 | *Cystolepiota seminude* (Lasch) Bon | *Cystolepiota* | Agaricaeae | Agaricales | - | √ |
| 20 | *Lactarius* sp. | *Lactarius* | Russulaceae | Russulales | - | √ |
| 21 | *Russula* cf. *Rosea* Pers. | *Russula* | Russulaceae | Russulales | √ | √ |
| 22 | *Marasmiellus* aff. *Candidus* (Fr.) Singer | *Marasmiellus* | Omphalotaceae | Agaricales | - | √ |
| 23 | *Gymnopus* aff. *Ramealis* (Bull.) Gray | *Gymnopus* | Omphalotaceae | Agaricales | √ | - |
| 24 | *Marasmiellus* sp. | *Marasmiellus* | Omphalotaceae | Agaricales | √ | - |
| 25 | *Mycena* sp. 1 | *Mycena* | Mycenaceae | Agaricales | - | √ |
| 26 | *Mycena* sp. 2 | *Mycena* | Mycenaceae | Agaricales | - | √ |
| 27 | *Mycena* aff. *leptocephala* (Pers.) Gilllet | *Mycena* | Mycenaceae | Agaricales | - | √ |
| 28 | *Lentinus tricholoma* (Mont.) Zmitr | *Lentinus* | Polyporaceae | Polyporales | - | √ |
| 29 | *Tyromyces* sp.1 | *Tyromyces* | Polyporaceae | Polyporales | - | √ |
| 30 | *Polyporus* sp.1 | *Polyporus* | Polyporaceae | Polyporales | - | √ |
| 31 | *Polyporus* sp. 2 | *Polyporus* | Polyporaceae | Polyporales | - | √ |
| 32 | *Trametes* cf. *ochracea* (Pers.) Gilb. & Ryvarden | *Trametes* | Polyporaceae | Polyporales | - | √ |
| 33 | *Lentinus arcularius* (Batsch) Zmitr. | *Lentinus* | Polyporaceae | Polyporales | - | √ |
| 34 | *Tyromyces* sp.2 | *Tyromyces* | Polyporaceae | Polyporales | - | √ |
| 35 | *Trichaptum biforme* (Fr.) Ryvarden | *Trichaptum* | Polyporaceae | Polyporales | √ | - |
| 36 | *Microporellus* sp. | *Microporellus* | Polyporaceae | Polyporales | √ | - |
| 37 | *Favolus grammocephalus* (Berk.) Imazeki | *Favolus* | Polyporaceae | Polyporales | √ | - |
| 38 | *Tyromyces* sp.3 | *Tyromyces* | Polyporaceae | Polyporales | √ | - |
| 39 | *Dacryopinax spathularia* (Schwein.) G.W.Martin | *Dacryopinax* | Dacrymycetaceae | Dacrymycetales | - | √ |
| 40 | *Phallus indusiatus* Vent. | *Phallus* | Phallaceae | Phallales | √ | - |
| 41 | *Auricularia auricula-judae* | *Auricularia* | Auriculariaceae | Auricurales | √ | - |
| 42 | *Suillus* cf. *granulatus* (L.) Roussel | *Suillus* | Suillaceae | Boletales | - | √ |
| 43 | *Tapinella panuoides* (Fr.) E.-J.Gilbert. | *Tapinella* | Tapinellaceae | Boletales | √ | - |
| 44 | *Laccaria* cf. *ochropurpurea* (Berk.) Peck | *Laccaria* | Hydnangiaceae | Agaricales | - | √ |
| 45 | *Oudemansiella* sp. | *Oudemansiella* | Physalacriaceae | Agaricales | √ | - |
| 46 | *Panaeolus* cf. *antillarum* (Fr.) Dennis | *Panaeolus* | Bolbitiaceae | Agaricales | √ | - |
| 47 | *Geastrum triplex* Jungh. | *Geastrum* | Geastraceae | Geastrales | √ | - |
| 48 | *Daldinia concentrica* (Bolton) Ces. & De Not. | *Daldinia* | Hypoxylaceae | Xylariales | √ | - |
| 49 | *Phillipsia domingensis* (Berk.) Berk. ex Denison | *Phillipsia* | Sarcoscyphaceae | Pezizales | √ | - |
| 50 | *Clymacocystis* sp. | *Clymacocystis* | Fomitopsidaceae | Polyporales | - | √ |

**Table 3.** Contd.

| No | Species | Genus | Family | Ordo | Line | |
|---|---|---|---|---|---|---|
| | | | | | Pakar | Maribaya |
| 51 | *Daedalea dochmia* (Berk. & Broome) T.Hatt. | *Daedalea* | Fomitopsidaceae | Polyporales | √ | - |
| 52 | *Crepidotus* sp. | *Crepidotus* | Inocybaceae | Agaricales | √ | - |
| 53 | *Crepidotus applanatum* (Pers.) P.Kumm. | *Crepidotus* | Inocybaceae | Agaricales | √ | - |
| 54 | *Russula* sp. | *Russula* | Russulaceae | Russulales | √ | - |
| 55 | *Stereum* sp.3 | *Stereum* | Stereaceae | Russulales | √ | - |
| 56 | *Stereum* cf. *ostrea* (Blume & T.Nees) Fr. | *Stereum* | Stereaceae | Russulales | √ | - |
| 57 | *Scleroderma columnare* Berk. & Broome | *Scleroderma* | Sclerodermataceae | Boletales | - | √ |
| 58 | *Sclerodema* sp. | *Sclerodema* | Sclerodermataceae | Boletales | √ | - |
| 59 | *Clitocybe fragrans* (With.) P.Kumm. | *Clitocybe* | Tricholomataceae | Agaricales | √ | - |
| 60 | *Collybia* aff. *cirrhata* (Schumach.) Quél. | *Collybia* | Tricholomataceae | Agaricales | √ | - |
| 61 | *Favolaschia manipularis* (Berk.) Teng | *Favolaschia* | Mycenaceae | Agaricales | √ | - |
| 62 | *Mycena leaiana* (Berk.) Sacc. | *Mycena* | Mycenaceae | Agaricales | √ | - |
| 63 | *Ganoderma* sp. | *Ganoderma* | Ganodermataceae | Polyporales | √ | - |
| 64 | *Ganoderma applanatum* (Pers.) Pat. | *Ganoderma* | Ganodermataceae | Polyporales | √ | - |
| 65 | *Marasmius* sp.1 | *Marasmius* | Marasmiaceae | Agaricales | √ | - |
| 66 | *Gerronema strombodes*(Berk. & Mont.) Singer | *Gerronema* | Marasmiaceae | Agaricales | √ | - |
| 67 | *Marasmius* sp.2 | *Marasmius* | Marasmiaceae | Agaricales | √ | - |
| 68 | *Xylaria* cf. *cubensis* (Mont.) Fr. | *Xylaria* | Xylariaceae | Xylariales | √ | - |
| 69 | *Xylaria polymorpha* (Pers.) Grev. | *Xylaria* | Xylariaceae | Xylariales | √ | - |
| 70 | *Xylaria Hypoxylon* (L.) Grev. | *Xylaria* | Xylariaceae | Xylariales | √ | - |
| 71 | *Coprinellus* aff. *disseminates* (Pers.) J.E.Lange | *Coprinellus* | Psathyrellaceae | Agaricales | - | √ |
| 72 | *Parasola plicatilis* (Curtis) Redhead, Vilgalys & Hopple | *Parasola* | Psathyrellaceae | Agaricales | √ | - |
| 73 | *Psathyrella* sp. | *Psathyrella* | Psathyrellaceae | Agaricales | √ | - |
| 74 | *Parasola* sp. | *Parasola* | Psathyrellaceae | Agaricales | √ | - |
| 75 | *Coprinopsis* sp. | *Coprinopsis* | Psathyrellaceae | Agaricales | √ | - |
| 76 | *Gymnopus* sp.1 | *Gymnopus* | Omphalotaceae | Agaricales | - | √ |
| 77 | *Gymnopus* sp.2 | *Gymnopus* | Omphalotaceae | Agaricales | √ | - |
| 78 | *Marasmiellus* sp. | *Marasmiellus* | Omphalotaceae | Agaricales | √ | - |
| 79 | *Gymnopus* sp.3 | *Gymnopus* | Omphalotaceae | Agaricales | √ | - |
| 80 | *Gymnopus* cf. *dryophilus* (Bull.) Murrill | *Gymnopus* | Omphalotaceae | Agaricales | √ | - |
| 81 | *Gymnopus* sp.4 | *Gymnopus* | Omphalotaceae | Agaricales | √ | - |
| 82 | *Hexagonia* sp.1 | *Hexagonia* | Polyporaceae | Polyporales | √ | - |
| 83 | *Nigroporus* sp. | *Nigroporus* | Polyporaceae | Polyporales | √ | - |
| 84 | *Hexagonia* sp.2 | *Hexagonia* | Polyporaceae | Polyporales | √ | - |
| 85 | *Trametes* sp. | *Trametes* | Polyporaceae | Polyporales | √ | - |
| 86 | *Polyporus* sp.3 | *Polyporus* | Polyporaceae | Polyporales | √ | - |
| 87 | *Earliella scabrosa* (Pers.) Gilb. & Ryvarden | *Earliella* | Polyporaceae | Polyporales | √ | - |
| 88 | *Agaricus* cf. *vinosobrunneofumidus* Kerrigan | *Agaricus* | Agaricaceae | Agaricales | - | √ |
| 89 | *Agaricus* sp.1 | *Agaricus* | Agaricaceae | Agaricales | - | √ |
| 90 | *Lepiota rubrotinctoides* Murrill. | *Lepiota* | Agaricaceae | Agaricales | √ | - |
| 91 | *Cyathus striatus* (Huds.) Willd. | *Cyathus* | Agaricaceae | Agaricales | √ | - |
| 92 | *Calvatia rugosa* (Berk. & M.A.Curtis) D.A.Reid | *Calvatia* | Agaricaceae | Agaricales | √ | - |
| 93 | *Agaricus trisulphuratus* Berk. | *Agaricus* | Agaricaceae | Agaricales | √ | - |
| 94 | *Agaricus* sp.2 | *Agaricus* | Agaricaceae | Agaricales | √ | - |
| 95 | *Agaricus* sp.3 | *Agaricus* | Agaricaceae | Agaricales | √ | - |
| 96 | *Leucocoprinus fagilissimus* (Ravenel ex Berk. & M.A.Curtis) Pat. | *Leucocoprinus* | Agaricaceae | Agaricales | √ | - |
| 97 | *Agaricus* sp. 4 | *Agaricus* | Agaricaceae | Agaricales | √ | - |
| 98 | *Cystoderma* sp. | *Cystoderma* | Agaricaceae | Agaricales | √ | - |
| 99 | *Agaricus* sp.5 | *Agaricus* | Agaricaceae | Agaricales | √ | - |

detached from the soil and may roll around. Upon maturity, their exoperidium splits into a number of varying colors, which gives the order a distinct star shape. The exoperidia exist to protect the endoperidial body and regulate spore dispersal. In wetter weather these petals become moist and do not curl, some even curl back lifting the spore sac upwards. This allows rain or animals to hit the spore sac, releasing the spores when there is sufficient moisture for them to reproduce (Kuhar et al. 2013).

The order Agaricales is the most familiar mushroom known to the public, where the term mushroom refers to this type. This mushroom is easy to be recognized because of its soft fruiting body characteristic, generally their shapes were like an umbrella with the bottom of the hood resembling a sheet (gills). Agaricales is considered a cosmopolitan mushroom that can easily grow in various habitats (Kusuma et al. 2021). The diversity of habitats and substrates occupied by these fungi indicates that the group of Agaricales includes saprophytic, symbiotic, and parasitic species in various of shapes, sizes, and colours. The order Agaricales includes 33 families (mainly the genus *Agaricus*), 413 genera, and more than 13,200 described species, together with six extinct genera known only from the fossil record (Kirk et al. 2008).

The order Pezizales has at least 16 families, 199 genera, and 1638 species. This order is characterized by the original which is usually open and broken so that the body is shaped like a bowl or plate. The fungi have ascospores that are single-celled, bilaterally or bipolar in shape. Several types of fungi in this order have their ascospores modified into ornaments that are visible on the surface such as warts or thorns (Hansen & Pfister 2006).

Phallales is an order of fungi in the subclass Phallomycetidae. Where in 2019, it was recorded that this order has two families, 39 genera, and 173 species. The most prominent family in this order is the Phallaceae and commonly referred to as the stinkhorn mushrooms. The most striking feature in this order is that they have a pseudo stalk which is hollow and usually the spores are present in a slime-like form. Ripe fruit bodies usually often smell like carrion. Most of this order grows in soil and leaf litter (Yakar et al. 2019).

The Xylariales order is the largest order in the Sordariomycetes class, the largest species in this order comes from the Xylariaceae family which until now consists of several genera including *Daldinia*, *Hypoxylon* and *Xylaria* which have striking fruit body shapes (Helaly et al. 2018). Xylariales is a large order of fungi from the division Ascomycota which contains more than 92 genera and 795 species (Smith et al. 2003).

It is known that two families in this order, Xylariaceae and Hypoxylaceae, represent one of the several lineages in this order that can produce the most productive secondary metabolites, like several other types of fungi, this order is also known to show quite varied diversity when living in the tropics. Several discoveries that have been made show that mycelium cultures of this order are often isolated and proven as materials for drug development (Becker & Stadler 2021).

The order Auriculariales includes all fungi with fruiting bodies that are simple to cobweb-shaped, do not have heminium (spores associated with the lining of certain fungi), and their bodies are also easily distinguishable. The characteristic of this order is that it has a fruiting body that is soft and supple, usually shaped like an earlobe (Hasibuan 2019). Auriculariales is also a typical order of the division Basidiomycota which has septate basidia that are elongated or transverse (Li et al. 2022).

According to Kirk et al. (2008), Boletales consists of 17 families, 96 genera, and 1316 species with various types of fruiting bodies. Boletes is the most well-known genus of this order, and until recently, Boletales was thought to consist of only one genus, *Boletes.* This order also includes several gilled mushrooms, in the families of Gomphidiaceae, Serpulaceae, Tapinellaceae, Hygrophoropsidaceae, and Paxillaceae, which often have a fleshy texture similiar to Boletes.

Taxonomic studies using secondary metabolites and molecular phylogenetic evidence then included several physically distinct groups within the Boletales, including Sclerodermataceae (earth globe) and Rhizopogonaceae (false truffles) (Wu et al. 2014). Fungi from this order usually live in the soil and most often act as ectomycorrhizae in woody higher plants (Mishra 2005).

Dacrymycetales is an order of the class Dacrymycetes which was identified in 2001, which is placed in the subphylum Agaricomycotina and phylum Basidiomycota. Fungi of this order are characterized by the presence of bifurcate basidia (shaped like branched fork) which have a gelatinous or cartilage-like consistency and vary in color from yellow, orange to brown with a variety of shapes (Castro-Santiuste et al. 2020). The order Dacrymycetales usually inhabits dead trees, fallen trunks, and branches of gymnosperms or angiosperms (Lian et al. 2022).

The order Polyporales is a group originating from the division Basidiomycetes which includes more than 1800 species from 216 genera and 13 families. Polyporales is said to have porous lamellae, large fruiting bodies that can live for years, and are fleshy when alive. The order Polyporales can live in fairly dry extreme conditions. The texture is usually hard like wood. The cells in the hyphae are usually thick-walled. Most of the spores are white, cream, or purple (Mishra 2005). Several genera in the order Polyporales include *Hexagonia*, *Tyromyces*, and *Polyporus.* All three have different characteristics, namely *Hexagonia* has a hexagon-shaped pore, *Tyromyces* has a fruiting body like cheese or styrofoam, while *Polyporus* has a small fruiting body in most of its species.

## Factors Influencing Macrofungi Growth

Macrofungi have different adaptation abilities in a habitat, several factors can affect the growth of mushrooms, including the substrate or habitat where the fungus grows. In addition to the substrate, factors that can affect the growth of fungi are conditions, such as soil acidity (pH), air humidity, and temperature.

The higher the humidity in a place, it will affect the humidity of macroscopic fungi that grow in a place (Hiola 2014). Table 4 shows that altitude affects air temperature. Higher air temperatures are found at altitudes of more than 1000 meters above sea level. This is in accordance with the statement of Warisno and Dahana (2013) which states that altitude can affect the growth of macrofungi indirectly, where temperature and rainfall are several factors that can be affected by altitude so that they can affect fungal growth.

According to Purwantara (2018), the low or high of earth's surface air temperature is determined by the altitude of the place, the higher the altitude, the lower the temperature, because the air pressure is getting smaller. The farther a place from the center of the earth, the weaker the gravitational force, which causes the pressure and air to get smaller, this thin air content causes the air temperature to be colder than on the beach. However, the altitude also affects the amount of sunlight that hits the earth's surface, this will affect the expected density of vegetation in an area.

According to Roosheroe et al. (2006), the high pH can affect the

**Table 4.** Influence of Abiotic Parameters on Altitudinal Distribution of Macrofungi.

| Block | Time | Line | Altitude (m asl) | Abiotic Factors | | |
|---|---|---|---|---|---|---|
| | | | | Temperature (°C) | Air Humidity (%) | Soil pH |
| Protection | November 2021 | Tonjong Sawah | 1077 – 1141 | 24 – 27 | 67 – 72 | 3.5 – 5.5 |
| | | Cibingkul | 1092 – 1124 | 23.4 – 29.3 | 54 – 67 | 3.5 – 6 |
| | | Pakar 1 | 976 – 987 | 23.1 – 27.3 | 65 – 78 | 4 – 5.5 |
| | | Goa Belanda | 873 – 896 | 23.3 – 27 | 53 – 64 | 3 – 5 |
| | February 2022 | Cibodas | 1056 – 1090 | 22.7 – 26.1 | 71 – 90 | 3.5 – 4 |
| | | Gunung Masigit | 1057 – 1076 | 24 – 26.9 | 63 – 82 | 3.5 – 4 |
| | | Seke Gede | 1102 – 1121 | 23.1 – 27.3 | 80 – 92 | 3.5 – 5 |
| | | Pakar 2 | 860 – 879 | 21.5 – 24.5 | 70 – 91 | 3.5 – 5 |
| Collection | November 2021 | Percoba Areng | 1216 – 1296 | 23.4 – 28.1 | 61 – 81 | 3.5 – 5 |
| | | Gunung Masigit | 1158 – 1227 | 23.6 – 25 | 73 – 87 | 3.5 – 6 |
| | January 2022 | Percoba Areng | 1109 – 1224 | 20.9 – 30.2 | 61 – 92 | 3.5 – 5 |
| | | Gunung Masigit | 1067 – 1166 | 25.3 – 26.5 | 65 – 81 | 3.5 – 5 |
| Utilization | January 2022 | Pakar | 929 – 956 | 20.4 –25.8 | 64 – 87 | 5 – 7 |
| | | Maribaya | 1047 – 1149 | 22.1 – 26.3 | 75 – 86 | 4.5 – 6.2 |
| | April 2022 | Pakar | 923 – 987 | 22.6 – 24.5 | 61 – 71 | 4 – 5.1 |
| | | Maribaya | 1138 – 1388 | 22.4 – 30.1 | 61 – 75 | 3.5 – 6.2 |

growth of fungi indirectly; the high pH will affect the availability of nutrients needed by macrofungi. In general, fungi can live at a fairly wide range of pH, namely 3 – 7, but the optimum pH for fungal growth is 6 – 7 where the nutrients used by macrofungi to grow are mostly available at this pH (Gardner et al. 1991). Macrofungi can also grow with a fairly wide temperature range between 20 – 40°C with the optimum temperature between 20 – 30°C. The amount of humidity affects the availability of water in the environment, humidity can affect the ability of fungi to maintain water levels in cells which can function as nutrient transport (Wati et al. 2019).

## Macrofungi Growth Subtance

Macrofungi from the divisions of Ascomycota and Basidiomycota can thrive in places that contain lots of carbohydrates, cellulose and lignin, these materials are commonly found in piles of leaf litter, tree branches, and weathered wood (Suhardiman 1995). Based on Figure 2 and Figure 3, macrofungi from the order Agaricales which grow a lot in the Protection and Utilization blocks mostly grow on soil substrates. These results are in accordance with Yunida et al. (2014) that Agaricales can grow well in areas with high humidity because it has a soft umbrella-like


**Figure 2.** Some of the Macrofungi found in the TAHURA Ir. H. Djuanda Area.

fruiting body that rarely tolerates dry conditions.

The Collection block was dominated by macrofungi from the order Polyporales which grow mostly on wood stumps. The order Polyporales is a type of fungus whose habitat is mostly on wood stumps or dead wood. This order type has special characteristics in the form of a hard basidiocarp in the shape of planks and has a high tolerance to the environment so that this fungus can survive in various seasons including the dry season (Wibowo et al. 2021). According to Annissa et al. (2017) most types of Polyporaceae are macrofungi that act as decomposers in the environment, therefore, these types of macrofungi are found mostly on dead wood stump and generally saprophytic. Sudirman (1995) also mentioned that in its growth, macrofungi often depend on the weathering of wood, where macrofungi utilize it as food sources whether weathered wood or still weathering wood.

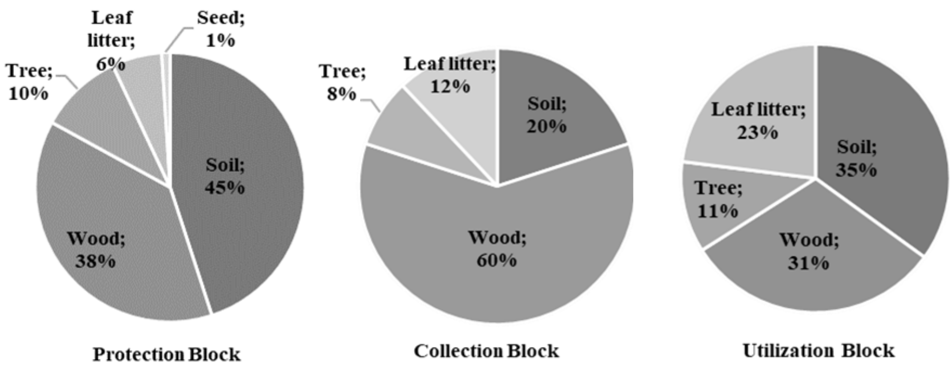


**Figure 3.** The Ecological Substrate Preferences of Macrofungi in The TAHURA Ir. H. Djuanda area.

## Potential Utilization of Macrofungi

The existence of macrofungi in ecosystems is very important to support the organisms life in the environment. Macrofungi have an important role in the environment, namely as decomposers by breaking down complex compounds into simple forms. The main content of macrofungi are fats, proteins, minerals, vitamins, water and fiber. However, there are some mushrooms that cannot be eaten because they are poisonous. In symbiont macrofungi, namely mycorrhizae, their presence is necessary for plantsin the area. Especially in woody plants, macrofungi can help absorb water and minerals from the soil. Macrofungi can also be used as a source of food and medicinal raw materials (Suryani & Cahyanto 2022).

Based on Figure 4, the potential utilization of macrofungi from each block shows that the collection block is most commonly used as an anti-microbial, the protection block is more frequently used as food, while the utilization block is primarily used for medicinal purposes. Macrofungi from the Ascomycota division have potential as food and medicine. The genus *Xylaria* is a key source of antioxidants with antibacterial and anti-fungal properties (Saridogan et al. 2021). while the genus Daldinia is known for relieving cramps, treating umbilical hernias, and possessing antibacterial, antifungal, and antimicrobial properties (Boua et al. 2019).

Mushrooms from the genus *Ganoderma* contain triterpenoids and polysaccharides, which serve as antioxidants, antibacterials, and protect against cell damage from radicals. These compounds have potential as bioactives for treating cancer, tumors, and boosting the immune system (Surahmaida 2017). Additionally, mycelium from the genus *Stereum* shows activity against *S. aureus* bacteria when tested with acetone, ethanol, and aqueous extracts. Researchers has proven that these fungi have the potential to inhibit the growth of gram positive and negative bacteria

(Ferreira Silva et al. 2017).

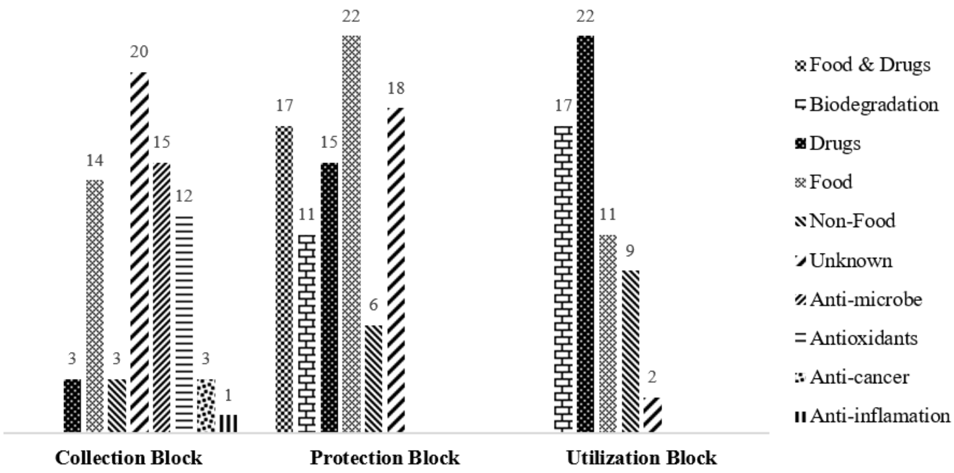


**Figure 4.** Potential Utilization of Macrofungi.

*Scizophyllum* is often used in food ingredients such as soup, it is known that some mushrooms from this order can function as a leucorrhoea medicine also has antitumor properties (Susan & Retnowati 2017). The genera *Auricularia* has the ability as an antibacterial and antioxidant so this fungus is known to be able to inhibit the growth of *E. coli* bacteria (Elfirta & Saskiawan 2020), besides its potential as a medicine, many Indonesian people consume one type of mushroom from this genus, namely *Auricularia auricular-judae* (Susan & Retnowati 2017). Mushroom species from several genera *Inocybe* and *Conocybe* are poisonous, although these mushrooms are proven to be ectomycorrhizal fungi, they are known to contain amanitin, psilocybin, psilocin, and baeocystin which can cause quite severe hallucinations. structurally similar to neurotransmitters (Annissa et al. 2017; Diaz 2018; Patocka et al. 2021).

The genus *Agaricus* has been used as an analgesic or pain reliever, several types of mushrooms from this genus are also known to contain fiber, protein, micronutrients, vitamins, carbohydrates, and have a low fat content so they are good for consumption. The genus *Pleurotus*, also known as oyster mushroom, has long been known to have high nutritional value and palatability. *Pelurotus ostreatus* type has tumor inhibitory properties, antibacterial activity, and cholesterol lowering. In addition, this mushroom can also control blood pressure against hypertension (Varghese et al. 2019). The genus *Phallus* was consumed by the people of ancient China because of its nutritional content besides having benefits for the eyes and tonic for the cardiovascular system, medicinal effects such as mental calming, antitumor and having the seven essential amino acids, calcium and high content of vitamin E (Ker et al. 2011). Based on the analysis results, the potential of macrofungi found in Ir. H. Djuanda Grand Forest Park in Bandung is dominated by fungi that can be utilized for medicinal and food purposes, such as one of them found in the genus *Marasmiellus*.

## CONCLUSION

Based on the results of the research, 83 species of macrofungi were found in the Protection block, 50 species were found in the Collection block, and 99 species were identified in the Utilization block from the Basidiomycota and Ascomycota phyla. The macrofungi found have the potential to act as biodegradation agents, food ingredients, non-food ingredients, medicines, antimicrobials, antioxidants, anticancer and anti-inflammatory.

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