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Checklist of Reported Macrofungi in the Philippines

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The Philippines is known for its ecological diversity due to its climatic condition and geographical location. However, despite having a wide range of organisms, the macrofungal species in the country remain poorly documented. Recent mycological research in the tropics states that more species have yet to be discovered in the Philippines. Despite this, a mycological study still focuses on the ethnomycological survey and species listing. In this study, a survey of publications in macrofungi from 1906 to the present revealed that the Philippines have currently 376 validated species names of macrofungi classified under 66 families and 130 genera. Macrofungal species reported in the country belong to class Ascomycota and Basidiomycota with high species diversity under family Agaricaceae, Lycoperdaceae, Marasmiaceae, and Polyporaceae. Most studies were published internationally and were concentrated in Luzon Island, Philippines. Looking into these, we suggest a biodiversity analysis of macrofungi in other regions of the country. A shift into applying molecular systematics and biotechnology would further develop Philippine macrofungal research, given that the historical trend has focused on morphological identification and classification. We hope that this paper will be a call to further fill the gaps in what is known about the macrofungi in the Philippines, given the country's potential for further discoveries.

Keywords: ascomycetes, basidiomycetes, macrofungi, Philippines

INTRODUCTION

Large fructifications of macrofungi are visible without using a microscope (Akata *et al.* 2010). The different macrofungal phyla are classified under Ascomycota and Basidiomycota. Frequently, macrofungi serve as a food source, alternative medicine, and raw materials in industries. These organisms also play vital roles in the ecosystem and are considered decomposers of many plant wastes and residues (Dulay and Magsalang 2017). Its diversity can also be observed in different types of forests and magnitudes of habitats, which gives rise to several microclimatic pockets suitable for the growth of macrofungi (Bhatt *et al.* 2018). However, according to

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Buyck *et al.* (2006), macrofungi are still underexplored worldwide. About 6.7% of the 1.5 million species of fungi estimated in the world have only been described, primarily in temperate regions (Acha *et al.* 2017).

The Philippines has one of the most diverse ecosystems in the world. Geographic isolation of the country and its ideal climatic conditions resulted in high endemicity between its flora and fauna (Dagamac *et al.* 2013), including macrofungal species. Early records of Philippine fungi are reports of various American and French expeditions and in the writings of early Spanish botanists – including Blanco (1837), Berkeley, Patoullard, Warburg, Meyer, Cumming, and Leveille. Most of these fungi recorded before 1900 belong to Agaricales and Polyporales under Division Basidiomycetes and a few of the ascomycetous macrofungi (Quimio 1986). As early as 1906, American botanist Ricker (1906) reported 156 species from 71 genera of fungal flora in the country; Baker in 1914 reported a higher record of about 638 fungal species belonging to 215 genera (Quimio 2001, 2002). On the other hand, Nicanor Teodoro (1937) credited the country with 2,979 fungal species from 620 genera, with mostly ascomycetes and basidiomycetes species (de la Cruz *et al.* 2009). A recent enumeration of Philippine fungi by Quimio (2002) reported 4,698 fungal species belonging to 1,031 genera. From the earlier works of Teodoro in 1937 until the list by Quimio in 2002, the number of fungal species credited to the country increased only by 36% over the past 65 years or with an average discovery rate of 26 species per year (de la Cruz *et al.* 2009). Quimio and her colleagues also worked on Agaricales and Auricularia, where all duplicates of published specimens are deposited at the Kew Herbarium (Quimio 1986). Documented studies on macrofungi include only a few regions in the Philippines including Bataan (Tayamen *et al.* 2004), Batangas (Tadiosa *et al.* 2007), Isabela (Jacob *et al.* 2017), Laguna (de Castro and Dulay 2015; Tadiosa *et al.* 2015; Paquit and Pampolina 2017), La Union (Tadiosa 1998; Tadiosa and Arsenio 2014), Nueva Ecija (Reyes *et al.* 2003; Musngi *et al.* 2005; Sibounnavong *et al.* 2008; Undan *et al.* 2016, Guzman *et al.* 2018), and Palawan (Capistrano *et al.* 2008; Kim *et al.* 2021). With these studies and the several additions to macrofungal species of the country, this paper aims: [1] to provide an updated checklist of macrofungi reported from the Philippines and [2] to discuss the challenges and opportunities of macrofungi research in the country. This is the first attempt to list together all macrofungi species recorded from published literature to provide an overview of macrofungi recorded to date in the country.

MATERIALS AND METHODS

We obtained all appropriate kinds of literature about the Philippine macrofungi by data mining citations using search engines including Google Scholar, PubMed, Science Open, ResearchGate, and BioOne. We surveyed journals and citations associated with recorded and published Philippine macrofungi published from 1906 up to the present, where the PRISMA framework was adopted to ensure all data included are accurate and reliable.

RESULTS

In this study, we recorded macrofungi taxa that belong to two significant phyla: Ascomycota, and Basidiomycota. Most of the collected species were from Luzon Island. Out of the 402 recorded and published species of macrofungi, we obtained 383 species of Basidiomycetes and nineteen species of Ascomycetes. However, only 376 species were validated on mycobank.com. The unvalidated species in the list are marked with an asterisk (*). The top 10 total families of each phylum and genus of macrofungi are presented in Table 1. Based on the results presented, 2015 has the highest number of recorded and published Philippine Macrofungi (Figure 1).

List of Reported Macrofungi in the Philippines

[1] Ascomycota

[1.1] Helotiaceae
Bisporella sulfurina (Quél.) S.E. Carp (Parlucha *et al.* 2021)

Hymenoscyphus herbarum (Pers.) Dennis in rotten branch of tree fern (Tadiosa *et al.* 2011)

[1.2] Helvellaceae
**Helvella lacunosa* Fr. (Jusayan and Vicencio 2019)

[1.3] Hyaloscyphaceae
Dasyscyphus apalus (Berk. and Broome) Dennis Plant debris, soil (Tadiosa *et al.* 2011)

[1.4] Hypoxylaceae
Daldinia concentrica (Bolton) Ces. and de Not in rotten trunk of bignay (*Antidesma bunius*), dead root of a tree and decaying wood (Tadiosa *et al.* 2007; de Leon *et al.* 2013b; Tadiosa and Briones 2013; Arenas *et al.* 2015, 2018; Niem and Baldovino 2015; Liwanag *et al.* 2017; Paguirigan *et al.* 2020; de Leon *et al.* 2021)

[1.5] Pezizaceae
Peziza repanda Pers. in rotten branch of Celtis and lanite (*Wrightia pubescens*) (Tadiosa *et al.* 2011; Arenas *et al.*

Table 1. List of top 10 reported macrofungi family under each phylum in the Phillippines.

Phylum	Family	Species	Phylum	Family	Species
Ascomycota	Helotiaceae	2	Basidiomycota	Agaricaceae	32
	Gyalectaceae	2		Fomitopsidaceae	11
	Helvellaceae	1*		Geastraceae	11
	Hyaloscyphaceae	1		Hymenochaetaceae	11
	Hypoxylaceae	1		Lycoperdaceae	12
	Pezizaceae	1*		Marasmiaceae	12
	Pyronemataceae	2		Phallaceae	10
	Sarcoscyphaceae	3		Polyporaceae	83
	Sarcosomataceae	1		Psathyrellaceae	10
	Xylariaceae	7		Tricholomataceae	10

*Species names not confirmed in mycobank.com

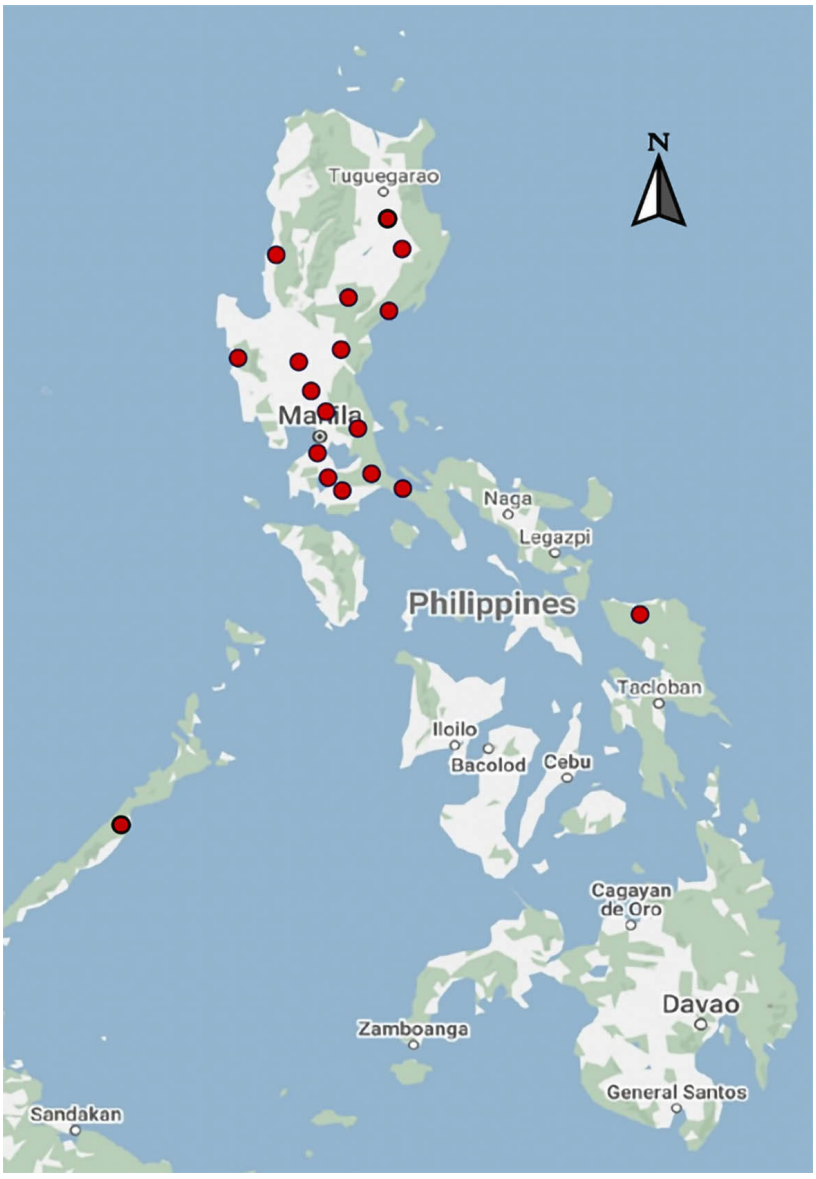

Figure 1. Map of the Philippines showing the regions where macrofungi were collected.

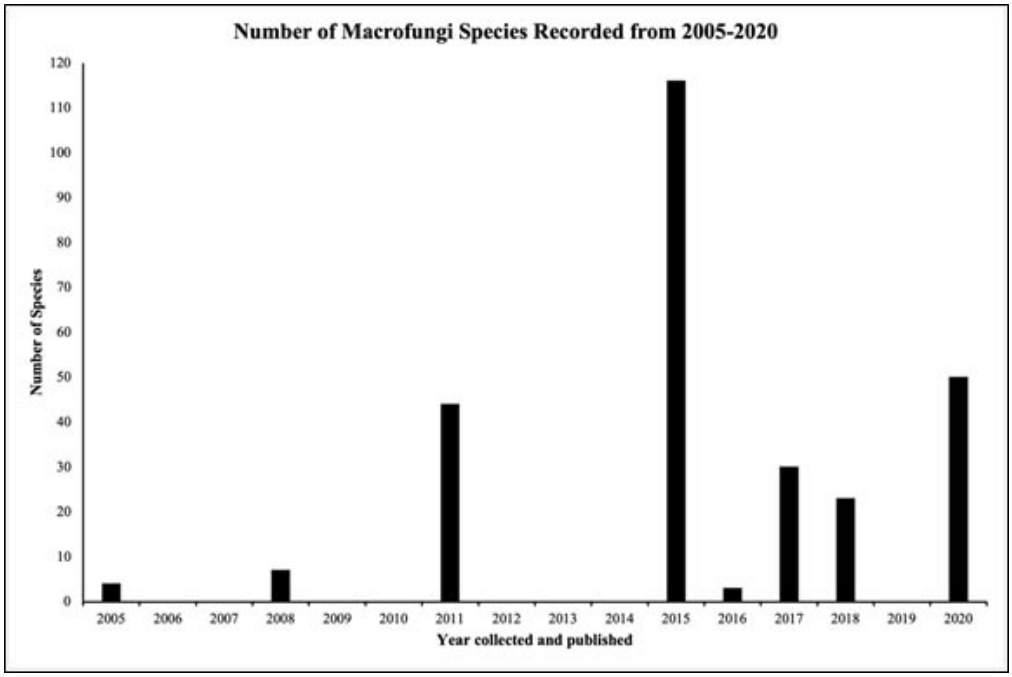

Figure 2. Number of macrofungal species recorded and published from years 2005–2020.

2015)

Plicariella scabrosa (Cooke) Spooner (Paguirigan *et al.* 2020)

[1.6] Pyronemataceae

Aleuria aurantia (Pers.) Fuckel. in rotten branch of unidentified tree (Tadiosa *et al.* 2011)

Octospora humosa (Fr.) Dennis in rotten root of tibig (*Ficus nota*) and *Diospyros* (Tadiosa *et al.* 2011; Tadiosa and Briones 2013; Arenas *et al.* 2015)

[1.7] Sarcoscyphaceae

Cookeina speciosa (Fr.) Dennis in decaying woods (Nacua *et al.* 2018)

Cookeina sulcipes (Berk.) Kuntze in rotten branch of unknown tree (Tadiosa and Briones 2013; Arenas *et al.* 2015; Parlucha *et al.* 2021)

Cookeina tricholoma (Mont.) Kuntze in rotten branch of banaba (*Lagerstroemia speciosa*) (Arenas *et al.* 2015, 2018; Liwanag *et al.* 2017; Parlucha *et al.* 2021)

[1.8] Sarcosomataceae

Galiella rufa (Schwein.) Martin (Tadiosa and Briones 2013; Arenas *et al.* 2018)

[1.9] Xylariaceae

Xylaria cornu-damae (Shwein.) Berk (Tadiosa and Briones 2013)

Xylaria filiformis (Alb. and Schwein.) Fr. (Tadiosa and Briones 2013)

Xylaria hypoxylon (Linn.) Grev. (Tadiosa and Briones 2013)

Xylaria longiana Rehm (Tadiosa and Briones 2013; Paguirigan *et al.* 2020)

Xylaria longipes Nitschke (Tadiosa and Briones 2013)

Xylaria papulis Lloyd (de Leon *et al.* 2020, 2021)

Xylaria polymorpha (Pers.) Grev. on fallen pieces of woods and stump of unknown tree (Tadiosa and Briones 2013; Arenas *et al.* 2015, 2018; Liwanag *et al.* 2017; Paguirigan *et al.* 2020)

[2] Basidiomycota

[2.1] Agaricaceae

Agaricus arvensis Schaeff. in termite mound (Jacob *et al.* 2017)

Agaricus bisporus (J.E. Lange) Imbach (Rubio and Alicbusan 1966; Quimio and Capilit 1981)

Agaricus campestris Linn. in soil, forested area (Santos and Bernardo 1966; Quimio and Capilit 1981; Tadiosa and Briones 2013; Arenas *et al.* 2015)

Agaricus comtulus Fr. (Dulay *et al.* 2020)

Agaricus moelleri Wasser (Paguirigan *et al.* 2020)

Agaricus perfuscus Copel. in decaying wood (de Castro and Dulay 2015)

Agaricus trisulphuratus (Berk.) Singer in soil (termite mound) (de Leon *et al.* 2013a)

Agaricus xanthodermus Genev. (Guerrero *et al.* 2020)

Chlorophyllum molybdites (G. Mey.) Massee soil (Culala and Dulay 2018; Guerrero *et al.* 2020)

Coprinus atramentarius (Bull.) Fr. soil, along the trail (Tadiosa *et al.* 2011; Arenas *et al.* 2018)

Coprinus cinereus (Schaeff.) Gray soil (Torres *et al.* 2020a)

Coprinus comatus (O.F. Mull) Pers. (Arenas *et al.* 2018; Reyes *et al.* 2009)

Coprinus disseminatus (Pers.) Gray soil, along the riverbanks; rotten ipil-ipil (*Leucaena leucocephala*) (Tadiosa *et al.* 2011; de Leon *et al.* 2013b; Arenas *et al.* 2015; Angeles *et al*. 2016)

Coprinus niveus (Pers.) Fr. soil, grassland (Tadiosa *et al.* 2011; Culala and Dulay 2018; Brazas *et al.* 2020)

Coprinus plicatilis (Curtis) Fr. (Angeles *et al*. 2016)

Coprinus plicatus (Pers.) Gray soil, grassland (Tadiosa *et al.* 2011)

Coprinus stercoreus Fr. rotten wood (Brazas *et al.* 2020)

Lepiota aspera (Pers.) Quél. Soil along riverbanks (Tadiosa *et al.* 2011)

Lepiota cristata (Bolton) P. Kumm. decaying leaves; soil, grassland (Tadiosa *et al.* 2011; Tadiosa and Briones 2013; Arenas *et al.* 2015; Angeles *et al*. 2016; Culala and Dulay 2018; Nacua *et al.* 2018)

Lepiota lilacea Bres. decaying wood (de Leon *et al.* 2021)

Lepiota rubrotincta Peck (Quimio and Suayan 1976; Quimio and Capilit 1981)

**Lepiota capaestipes* Fr. (Mendoza 1935; Quimio and Capilit 1981)

Lepiota sulphopenita P.W. Graff (Mendoza 1935; Quimio and Capilit 1981)

**Leucoagaricus cepaestipes* (de Leon *et al.* 2016)

Leucocoprinus birnbaumii (Corda) Singer (Culala and Dulay 2018)

Leucocoprinus fragilissimus (Berk. and M.A. Curtis) Pat. leaf litter (Brazas *et al.* 2020)

Macrolepiota procera (Scop.) Singer soil (de Leon *et al.* 2013a)

Macrolepiota rhacodes (Vittad.) Singer soil, thickets (Tadiosa *et al.* 2011; de Leon *et al.* 2013a)

Micropsalliota furfuracea R.L.Zhao, Desjardin, K. Soytong and K.D. Hyde (Kim *et al.* 2021)

**Nidula edmonse* (Berk.) Lloyd (Reynolds 1967; Quimio and Capilit 1981)

Tulostoma brumale Pers. (Reynolds 1967; Quimio and Capilit 1981)

Tulostoma exasperatum Mont. (Reynolds 1967; Quimio and Capilit 1981)

Tulostoma mussooriense Henn (Reynolds 1967; Quimio and Capilit 1981)

Tulostoma pusillum Berk. (Reynolds 1967; Quimio and Capilit 1981)

Vascellum pratense (Pers.) Kreisel (de Leon *et al.* 2013b, 2018)

Xanthagaricus flavosquamosus T.H. Li, and Z.P. Song (Guerrero *et al.* 2020)

[2.2] Albatrellaceae

Albatrellus ellisii (Berk.) Pouzar (Culliao *et al.* 2020)

[2.3] Amanitaceae

Amanita cokeri E.-J. Gilbert and Kühner ex E.-J. Gilbert soil (de Leon *et al.* 2013a)

Amanita fulva Fr. soil, along the trail (Tadiosa *et al.* 2011)

Amanita muscaria (L.) Lam. (Mendoza 1935; Quimio and Capilit 1981)

Amanita onusta (Howe) Sacc. (Culala and Dulay 2018)

Amanita virosa Bertill. (Quimio and Suayan 1976; Quimio and Capilit 1981)

[2.4] Aphelariaceae

Aphelaria incarnata Corner (Dogma 1966b; Quimio and Capilit 1981)

Aphelaria tasmanica (Lloyd) Corner (Dogma 1966b; Quimio and Capilit 1981)

Aphelaria flagelliformis (Berk.) Corner (Dogma 1966b; Quimio and Capilit 1981)

[2.5] Auriculariaceae

Auricularia auricula (L.) Underw. in rotten branch of kakawate; dead wood of mango, mahogany and unknown host; trees and shrubs (Musngi *et al.* 2005; Tadiosa *et al.* 2011; de Leon *et al.* 2012, 2013a; de Castro and Dulay 2015; de Leon *et al.* 2015; Lazo *et al.* 2015; Niem and Baldovino 2015; Angeles *et al*. 2016; de Leon *et al*. 2018; Brazas *et al.* 2020; Paguirigan *et al.* 2020; de Leon *et al.* 2021)

**Auricularia auricula-judae* (Mont.) Sacc > *Auricularia auricula-judae* (Bull.) Quél. Decaying log; rotten branch of malaruhat (*Syzygium subcaudatum*) and white lauan (*Shorea contorta* Vid.), dead branch (Tadiosa and Militante 2006; Tadiosa *et al.* 2007; Tadiosa and Briones 2013; Tadiosa and Arsenio 2014; Arenas *et al.* 2015; Jacob *et al.* 2017; Arenas *et al.* 2017; Tantengco and Ragragio

2018; Torres *et al.* 2020a, b; Guerrero *et al.* 2020; Guerrero *et al.* 2020)

Auricularia cornea Ehrenb. Raintree, kakawate (Tadiosa and Briones 2013; Tadiosa and Arsenio 2014)

Auricularia delicata (Mont.) Henn. on rotten stump of *Ficus*; rotten root of narra (*Pterocarpus indicus*) (Tadiosa *et al.* 2011; Arenas *et al.* 2015; Paguirigan *et al.* 2020)

Auricularia fuscosuccinea (Mont.) Henn. on dead mango, rain tree and unknown host; dead woods and branches (Quimio and Capilit 1981; Musngi *et al.* 2005; Sibounnavong *et al.* 2008; Tadiosa and Briones 2013; de Leon *et al.* 2015; Lazo *et al.* 2015)

Auricularia mesenterica (Dicks.) Pers. rotten trunk of molave (*Vitex parvifora*), tree branches (de Leon *et al.* 2013a; Tadiosa and Briones 2013; Tadiosa and Arsenio 2014; Arenas *et al.* 2015; Arenas *et al.* 2017)

Auricularia polytricha (Mont.) Sacc. on decaying log/wood; on dead trunk and branches of coconut, mango, rain tree, rubber tree and mahogany; rotten log; rotten trunk of alibangbang (*Bauhinia purpurea*), and dipterocarps (Quimio and Capilit 1981; Musngi *et al.* 2005; Tadiosa and Militante 2006; Tadiosa *et al.* 2011; de Leon *et al.* 2012, 2013a; Tadiosa and Arsenio 2014; Arenas *et al.* 2015; de Castro and Dulay 2015; Angeles *et al*. 2016; Jacob *et al.* 2017; Arenas *et al.* 2017; Tantengco and Ragragio 2018; Jusayan and Vicencio 2019; Brazas *et al.* 2020; Paguirigan *et al.* 2020; Torres *et al.* 2020a, b)

Auricularia tenuis (Lév.) Farl. on dead trunk of rain tree and on decaying stump of unknown host (Musngi *et al.* 2005; de Leon *et al.* 2013a)

[2.6] Bankeraceae
Phellodon niger (Fr.) P. Karst (de Leon *et al.* 2013a)

[2.7] Bolbitiaceae
Conocybe arrhenii (Fr.) Kits van Wav. decaying banana (de Leon *et al.* 2021)

Conocybe tenera (Schaeff.) Kühner dead grass, decayed woods, and dung (Brazas *et al.* 2020)

**Strombilomyces strobilaceus* (Stop.) Berk. soil, along the trail (Tadiosa *et al.* 2011)

[2.8] Bondarzewiaceae
Heterobasidion annosum (Fr.) Bref. decaying woods (Nacua *et al.* 2018)

[2.9] Cantharellaceae
Cantharellus aureus (Berk. and Curtis) Bres. (Tadiosa and Briones 2013)

Cantharellus cibarius Fr. (Arenas *et al.* 2018)

Cantharellus infundibuliformis (Scop.) Fr. log in advance stage of decomposition; rotten stump of yemane (*Gmelina arborea*) (Tadiosa *et al.* 2007; Tadiosa and Arsenio 2014; Arenas *et al.* 2015, 2018; de Castro and Dulay 2015; Angeles *et al*. 2016)

Cantharellus minor Peck dead twig (Sibounnavong *et al.* 2008)

[2.10] Clathraceae
**Clathrus elmeri* Bress. (Reynolds 1967; Quimio and Capilit 1981)

**Clathrus montagnel* Tul. (Reynolds 1967; Quimio and Capilit 1981)

**Clathrus poppigii* Tul. (Reynolds 1967; Quimio and Capilit 1981)

**Clathrus striatus* Per. (Reynolds 1967; Quimio and Capilit 1981)

Pseudocolus javanicus (Penz.) Lloyd (Reynolds 1967; Quimio and Capilit 1981)

[2.11] Clavulinaceae
Clavulina cristata (Holmsk.) J. Schröt. bark of tree (Jacob *et al.* 2017)

**Clavulina banahaonsis* Dogma (Dogma 1967; Quimio and Capilit 1981)

Clavulina rugosa (Bull.) J. Schröt. (Dogma 1967; Quimio and Capilit 1981)

[2.12] Coniophoraceae
Coniophora puteana (Schumach) P. Karst. soil (grassland) (Arenas *et al.* 2015)

[2.13] Corticiaceae
Corticium confluens (Fr.) Fr. (Arenas *et al.* 2018)

Corticium salmonicolor Berk. and Broome rotten branch of guava (*Psidium guajava*); citrus; coffee (Hurtado 1936; del Rosario 1968; Quimio and Capilit 1981; Tadiosa and Arsenio 2014; Arenas *et al.* 2015, 2018)

Corticium sasakii (Shirai) H. Matsumoto (Santos and Ou 1970; Quimio and Capilit 1981)

Pulcherricium caeruleum (Lam.) Parmasto rotten branch of guava (*Psidium guajava*) (Arenas *et al.* 2015)

[2.14] Cortinariaceae
Cortinarius callisteus (Fr.) Fr. Rotten trunk of lamio (*Dracontomelon edule*) (Arenas *et al.* 2015, 2018; Angeles *et al*. 2016)

Cortinarius corrugatus Peck. (Jusayan and Vicencio 2019)

[2.15] Crepidotaceae
Crepidotus herbarum (Peck) Peck living bark of a tree (de Castro and Dulay 2015; Arenas *et al.* 2018)

Crepidotus mollis (Schaeff.) Staude rotten root of tibig; decaying log (*Ficus nota*) (Arenas *et al.* 2015; Angeles *et al*. 2016; de Leon *et al.* 2021)

Crepidotus variabilis (Pers.) P. Kumm dead twigs of broad-leaved trees (Brazas *et al.* 2020)

[2.16] Dacrymycetaceae
Dacryopinax spathularia (Schwein.) G.W. Martin On rotten stump of white Lauan; rotten trunk of guijo (*Shorea guiso*); decaying woods (Tadiosa *et al.* 2007, 2011; de Leon *et al.* 2013a; Tadiosa and Briones 2013; Tadiosa and Arsenio 2014; Arenas *et al.* 2015, 2018; Angeles *et al*. 2016; Nacua *et al.* 2018; Guerrero *et al.* 2020)

[2.17] Dacryobolaceae
Postia fragilis (Fr.) Jülich (Culliao *et al.* 2020)

[2.18] Entolomataceae
Entoloma cetratum (Fr.) M.M. Moser grasses and woods (Brazas *et al.* 2020)

Entoloma lividum (Bull.) Quél. soil (grassland) (Arenas *et al.* 2015, 2018)

Entoloma serrulatum (Fr.) Hesler soil, grassland (Tadiosa *et al.* 2011)

[2.19] Fomitopsidaceae
Daedalea amanitoides Baeuv. on tree branches, and on rotten trunk of dao (*Dracontomelon dao*) (Tadiosa and Arsenio 2014; Arenas *et al.* 2015)

**Daedalea ambigua* Berk. on wood of dipterocarps; dead wood and rotten roots of lisihan (*Aglaia* sp.) (Tadiosa and Militante 2006; Tadiosa and Arsenio 2014; Arenas *et al.* 2015, 2018; Angeles *et al*. 2016; Liwanag *et al.* 2017; Brazas *et al.* 2020)

Daedalea confragosa (Bolt.) J. Schroeter (de Leon *et al.* 2013b; Tadiosa and Briones 2013)

Daedalea coprophila (Guerrero *et al.* 2020)

Daedalea dickinsii Yasuda decaying log (Jacob *et al.* 2017)

Daedalea elegans Spreng. decaying wood (Eusebio 1969; Quimio and Capilit 1981)

Daedalea flavida Lév. on decaying wood, and rotten stump of unknown tree (Eusebio 1969; Quimio and Capilit 1981; Tadiosa and Arsenio 2014; Arenas *et al.* 2015; Angeles *et al*. 2016; Guerrero *et al.* 2020)

Daedalea hobsoni Berk. stumps (Tadiosa and Arsenio 2014)

Daedalia palisoti Fr. stumps (Tadiosa and Arsenio 2014)

Daedalea quercina (Linn.) Pers. (Tadiosa and Briones 2013)

Fomitopsis feei (Fr.) Kreisel decaying log (de Leon *et al.* 2021)

Fomitopsis rosea (Alb. and Schwein) P. Karst. (Gaylan *et al.* 2018)

[2.20] Ganodermataceae
Amauroderma auriscalpium (Pers.) Torrend wood trunks (Tadiosa and Arsenio 2014)

Amauroderma rugosum (Blume and T. Nees) Torrend on rotten roots of Colona; rotten roots of guijo (*Shorea guiso*) (Tadiosa *et al.* 2011; Tadiosa and Arsenio 2014; Arenas *et al.* 2015; Angeles *et al*. 2016; Parlucha *et al.* 2021)

Ganoderma adspersum (Schulzer) Donk bark of tree (Jacob *et al.* 2017; Jusayan and Vicencio 2019)

Ganoderma applanatum (Pers.) Pat. decaying log; rotten trunk of akleng-parang (*Albizzia procera*); wood (Tadiosa and Militante 2006; au; de Leon *et al.* 2013a; Tadiosa and Briones 2013; Tadiosa and Arsenio 2014; Arenas *et al.* 2015, 2017, 2018; de Castro and Dulay 2015; Angeles *et al*. 2016; Jacob *et al.* 2017; Liwanag *et al.* 2017; Gaylan *et al.* 2018; Brazas *et al.* 2020; Guerrero *et al.* 2020; Torres *et al.* 2020a; de Leon *et al.* 2021; Parlucha *et al.* 2021)

Ganoderma australe (Fr.) Pat. (Torres *et al.* 2020b)

Ganoderma fornicatum (Fr.) Pat. in decaying wood (de Leon *et al.* 2021)

Ganoderma japonicum (Fr.) Sawada in bark of tree (Jacob *et al.* 2017)

Ganoderma lobatum (Schwein.) G.F. Atk. on branch of talisay-gubat (Tadiosa *et al.* 2011)

Ganoderma lucidum (Curtis) P. Karst. coconut; bark of tree; decaying woods; rotten roots of lisihan (*Aglaia* sp.); wood (del Rosario 1967; Tadiosa and Militante 2006; de Leon *et al.* 2012; Tadiosa and Briones 2013; Tadiosa and Arsenio; de Leon *et al.* 2013b, 2014; Arenas *et al.* 2015, 2017, 2018; de Castro and Dulay 2015; Angeles *et al*. 2016; Reyes and Nair 2016; Jacob *et al.* 2017; Gaylan *et al.* 2018; Nacua *et al.* 2018; Tantengco and Ragragio 2018; Jusayan and Vicencio 2019; Brazas *et al.* 2020; Torres *et al.* 2020a, b; de Leon *et al.* 2021)

Ganoderma mangiferae (Lev.) Pat. trunk of mango tree (*Mangifera indica*) (Tadiosa and Arsenio 2014)

Ganoderma neo-japonicum Imazeki wood of living trees (de Leon *et al.* 2013a)

Ganoderma sinense J.D. Zhao, L.W. Hsu and X.Q. Zhang decaying woods (de Leon *et al.* 2013a; Hou *et al.* 2017; Nacua *et al.* 2018;)

Ganoderma tsugae Murrill rotten stump of katmon (*Dillenia philippinensis*) (Arenas *et al.* 2015; Torres *et al.* 2020b)

[2.21] Geastraceae
Geastrum fimbriatum Fr. dried leaves (Jacob *et al.* 2017)

Geastrum saccatum Fr. rotten trunk of takip-asin (*Macaranga grandifolia*) (Reynolds 1967; Quimio and Capilit 1981; Arenas *et al.* 2015)

Geastrum triplex Jungh. dried leaves; stumps (Reynolds 1967; Quimio and Capilit 1981; Tadiosa and Arsenio 2014; de Castro and Dulay 2015; Jacob *et al.* 2017; Arenas *et al.* 2018)

Geastrum comptus Syd. and P. Syd. (Reynolds 1967; Quimio and Capilit 1981)

Geastrum fornicatum (Huds.) Hook (Reynolds 1967; Quimio and Capilit 1981)

Geastrum hygrometricum Pers. (Reynolds 1967; Quimio and Capilit 1981)

Geastrum mirabile Mont. (Reynolds 1967; Quimio and Capilit 1981)

Geastrum recolligens (With.) Desv. (Reynolds 1967; Quimio and Capilit 1981)

Geastrum rufescens Pers. (Reynolds 1967; Quimio and Capilit 1981)

Geastrum saccatum Fr. (Angeles *et al*. 2016)

Geastrum tonkinensis Pat. (Reynolds 1967; Quimio and Capilit 1981)

Geastrum velutinum Morgan (Reynolds 1967; Quimio and Capilit 1981)

[2.22] Gloeophyllaceae
Gloeophyllum striatum (Fr.) Murrill (PNMCC 2012)

[2.23] Hydnangiaceae
Laccaria laccata (Scop.) Cooke (Jusayan and Vicencio 2019)

[2.24] Hygrophoraceae
Hygrocybe coccinea (Schaeff.) P. Kumm. soil, plant debris (Tadiosa *et al.* 2011)

Hygrocybe miniata (Fr.) P. Kumm. soil, along the trail (Tadiosa *et al.* 2011; Arenas *et al.* 2018; Guerrero *et al.* 2020)

Hygrocybe nitida (Berk. and M.A. Curtis) Murrill rotten wood (Brazas *et al.* 2020)

Hygrophorus pratensis (Schaeff.) Fr. soil (forested area) (Arenas *et al.* 2015, 2018; Angeles *et al*. 2016)

[2.25] Hygrophoropsidaceae
Hygrophoropsis aurantiaca (Wulfen) Maire soil (forested area) (Arenas *et al.* 2015)

[2.26] Hymenochaetaceae
Coltricia perennis (L.) Murrill Ground (Sibounnavong *et al.* 2008)

Hymenochaete rubiginosa (Dicks.) Lév. on rotten stump of Molave; rotten Trunk of bolong-eta (*Diospyros pilosanthera*) (Tadiosa *et al.* 2011; Arenas *et al.* 2015, 2018; Angeles *et al*. 2016)

Hymenochaete tenuissima (Berk.) Berk on decaying log, and dipterocaps (Tadiosa and Militante 2006; Torres *et al.* 2020a, b)

Phellinus linteus (Berk. and M.A. Curtis) Teng bark of tree (Jacob *et al.* 2017)

Phellinus igniarius (L.) Quél. decaying log; trunk of trees (Jacob *et al.* 2017; Brazas *et al.* 2020)

Phellinus gilvus (Schwein.) Pat. on decaying log and white lauan (*Shorea contorta* Vid.) (Tadiosa and Militante 2006; Tadiosa and Arsenio 2014; Angeles *et al*. 2016; Jacob *et al.* 2017)

Phellinus pini (Brot.) A. Ames dead trunks (Sibounnavong *et al.* 2008)

Phellinus punctatus (P. Karst.) Pilát trunk and branches of trees (Brazas *et al.* 2020)

[2.27] Hypoxylaceae
Hypoxylon fragiforme (Persoon) J. Kickx f. (Paguirigan *et al.* 2020)

[2.28] Irpicaceae
**Gloeporus dichrous* (Fr.) Bres. dead wood (Sibounnavong *et al.* 2008)

[2.29] Lachnocladiaceae
Lachnocladium flavidum Corner (Dogma 1966b; Quimio and Capilit 1981)

[2.30] Inocybaceae
Inocybe rimosa (Bull) P. Kumm. (Jusayan and Vicencio 2019)

[2.31] Irpicaceae
Irpex flavus Klotzsch on twigs (Tadiosa and Arsenio 2014)

Irpex lacteus (Fr.) Fr. dead log (de Leon *et al.* 2021)

[2.32] Ischnodermataceae
Ischnoderma resinosum (Schrader) P. Karsten (Paguirigan *et al.* 2020)

[2.33] Lycoperdaceae

Bovista jonesii P.W. Graff (Reynolds 1967; Quimio and Capilit 1981)

Calvatia cyathiformis (Bosc.) Morgan in termite mount (Reynolds 1967; Quimio and Capilit 1981; Jacob *et al.* 2017)

Calvatia gigantea (Batsch ex Pers.) Lloyd soil (grassland) (de Leon *et al.* 2013a)

Calvatia lilacina (Mont. and Berk.) Henn (Santos and Bernardo 1966; Quimio and Capilit 1981)

Lycoperdon echinatum Pers. soil, plant debris (Tadiosa *et al.* 2011)

Lycoperdon asperum (Lév.) Speg. (Reynolds 1967; Quimio and Capilit 1981)

Lycoperdon mammiforme Pers. (Jusayan and Vicencio 2019)

Lycoperdon microspermum Berk. (Reynolds 1967; Quimio and Capilit 1981)

Lycoperdon perlatum Pers. (de Leon *et al.* 2013a)

Lycoperdon plicatum Berk and M.A. Curtis (Reynolds 1967; Quimio and Capilit 1981)

Lycoperdon pyriforme Schaeff. (Santos and Bernardo 1966; Quimio and Capilit 1981)

Lycoperdon pusillum Batsch. (Reynolds 1967; Quimio and Capilit 1981)

[2.34] Lyophillaceae

Termitomyces albuminosus (Berk.) R. Heim (Arenas *et al.* 2018)

Termitomyces bulborhizus T.Z. Wei, Y.J. Yao, B. Wang and Pegler (Guerrero *et al.* 2020)

Termitomyces clypeatus R. Heim on soil, and soil near termite mound (de Leon *et al.* 2012; de Castro and Dulay 2015; Reyes *et al.* 2016; Arenas *et al.* 2018; Culala and Dulay 2018)

*Termitomyces eurrhizus (*Berk.) R. Heim (Tadiosa *et al.* 2007; de Leon *et al.* 2013b; Arenas *et al.* 2018; Culliao *et al.* 2020)

Termitomyces robustus on soil (de Leon *et al.* 2012, 2013b)

Termitomyces striatus (Beeli) R. Heim on soil (Arenas *et al.* 2015; Angeles *et al*. 2016; Jacob *et al.* 2017)

Termitomyces bulborhizus T.Z. Wei, Y.J. Yao, B. Wang and Pegler on soil (Reyes *et al.* 2016)

[2.35] Marasmiaceae

Crinipellis scabella (Alb. and Schwein.) Murrill on leaf litters and soil (Brazas *et al.* 2020)

Favolaschia calocera R. Heim (Kim *et al.* 2021)

Favolaschia pustulosa (Jungh.) Kuntze on wood (Brazas *et al.* 2020)

Marasmius androsaceus (L.) Fr. on leaf litter (Tadiosa *et al.* 2011; de Leon *et al.* 2013a)

Marasmius haematocephalus (Mont.) Fr. on rotten wood and soil (Brazas *et al.* 2020)

Marasmius oreades (Bolton) Fr. on decaying branch (Guerrero *et al.* 2020)

Marasmius plicatulus Peck on leaf litters (Guerrero *et al.* 2020)

Marasmius ramealis (Bull.) Fr. on rotten wood (Tadiosa *et al.* 2011; Arenas *et al.* 2018)

Marasmius rotula (Scop.) Fr. on rotten wood and soil (plantation area) (Tadiosa *et al.* 2011; de Leon *et al.* 2013a; Tadiosa and Arsenio 2014; Arenas *et al.* 2015, 2018; Angeles *et al*. 2016; Guerrero *et al.* 2020)

Marasmius sacchari Wakker on sugarcane (Divinagracia 1957; Quimio and Capilit 1981)

Marasmius scorodonius (Fr.) Fr. on rotten log, soil, and leaf litters (de Castro and Dulay 2015; Jusayan and Vicencio 2019; Brazas *et al.* 2020)

Marasmius semiustus Berk. and M.A. Curtis on abaca (Quimio and Capilit 1981)

Marasmius siccus Fries (1838) on decaying leaves, and soil (de Leon *et al.* 2013a; Culala and Dulay 2018; Guerrero *et al.* 2020)

[2.36] Meripilaceae

Meripilus giganteus (Pers.) P. Karst. (de Leon *et al.* 2016)

Rigidoporus microporus (Sw.) Overeem (Niem and Baldovino 2015; Torres *et al.* 2020b)

[2.37] Meruliaceae

Cymatoderma africanum Boidin on rotten branch of *Syzygium* (Tadiosa *et al.* 2011)

Cymatoderma elegans Jungh. (Tadiosa and Briones 2013; Arenas *et al.* 2018; Guerrero *et al.* 2020; Kim *et al.* 2021; Parlucha *et al.* 2021)

Merulius incarnatus Schwein. on rotten root of takip asin (*Macaranga grandifolia*) (Arenas *et al.* 2015)

[2.38] Mycenaceae

Mycena acicula (Schaeff.) P. Kumm. on soil (denuded area) and wood (Arenas *et al.* 2015; Brazas *et al.* 2020)

Mycena alcalina (Fr.) P. Kumm. on branches of a tree, rotten log, and wood (Brazas *et al.* 2020)

Mycena cinerella (P. Karst.) P. Karst. on soil and leaf litters

(Brazas *et al.* 2020)

Mycena clavularis (Batsch) Sacc. on the bark of trees (Brazas *et al.* 2020)

Mycena fibula (Bull.) Kühner on the bark of trees and leaf litters (Brazas *et al.* 2020)

Mycena galericulata (Scop.) Gray on rotten wood and soil (Brazas *et al.* 2020)

Mycena galopus (Pers.) Kumm. on the soil in forested area (Arenas *et al.* 2015; Angeles *et al*. 2016)

Mycena pura (Pers.) P. Kumm on wood and soil (Brazas *et al.* 2020)

Mycena vulgaris (Pers.) P. Kumm. on leaf litters, soil, and wood (Brazas *et al.* 2020)

Panellus mitis (Pers.) Singer dead trunk (de Leon *et al.* 2021)

[2.39] Nidulariaceae

Cyathus rudis Pat. on stumps (Tadiosa and Arsenio 2014)

Cyathus striatus (Huds.) Willd. on rotten root of aklengparang (*Albizzia procera*) (de Leon *et al.* 2013a; Tadiosa and Arsenio 2014; Arenas *et al.* 2015, 2018; Guerrero *et al.* 2020)

[2.40] Phallaceae

Aseroe rubra Labill. on soil in forest floor (Reynolds 1967; Quimio and Capilit 1981; Tadiosa *et al.* 2011)

Dictyophora duplicata (Bosc.) E. Fisch. (de Leon *et al.* 2013a; Arenas *et al.* 2018)

Dictyophora indusiata (Vent.) Desv. (Reynolds 1967; Quimio and Capilit 1981; Arenas *et al.* 2017)

Dictyophora merulina Berk. (Reynolds 1967; Quimio and Capilit 1981)

**Lysurus brownie* Mendoza (Reynolds 1967; Quimio and Capilit 1981)

Mutinus bambusinus (Zoll.) E. Fisch. (Reynolds 1967; Quimio and Capilit 1981)

Mutinus caninus (Huds.) Fr. on decaying leaf litter (de Leon *et al.* 2013a)

Phallus duplicatus Bosc on soil (de Leon *et al.* 2013a)

Phallus indusiatus Vent. (Jusayan and Vicencio 2019; Guererro *et al.* 2020)

Phallus multicolor (Berk. and Broome) Cooke (Jusayan and Vicencio 2019; de Leon *et al.* 2013a)

Simblum periphragmoides Klotzsch (Reynolds 1967; Quimio and Capilit 1981)

[2.41] Omphalotaceae

Gymnopus luxurians (Peck.) Murill (Kim *et al.* 2021)

Lentinula edodes (Berk) Pegler (PNMCC 2012)

Marasmiellus candidus (Fr.) Singer (Guerrero *et al.* 2020)

Marasmiellus palmivorus (Sharples) Desjardin (Guerrero *et al.* 2020)

Marasmiellus ramealis (Bull.) Singer on *nipa* branch (Parlucha *et al.* 2021; de Leon *et al.* 2013b; Guerrero *et al.* 2020)

[2.42] Panaceae

Panus rudis Fr. on rotten root of takip asin (*Macaranga grandifolia*) (Arenas *et al.* 2015, 2018; Angeles *et al*. 2016)

[2.43] Phanerochaetaceae

Bjerkandera adusta (Willd.) P. Karst (Jusayan and Vicencio 2019)

Phanerochaete chrysorhizon (Parlucha *et al.* 2021)

[2.44] Phyllotopsidaceae

Pleurocybella porrigens (Pers.) Singer on the bark of a tree (Tadiosa and Briones 2013; Jacob *et al*. 2017; Jusayan and Vicencio 2019)

[2.45] Physalacriaceae

Oudemansiella canarii (Jungh.) Höhn. on wood at early stage of decomposition and soil (Tadiosa *et al.* 2011; de Castro and Dulay 2015; de Leon *et al.* 2018; Culala and Dulay 2018)

Oudemansiella radicata (Relhan) Singer on soil in grassland (Tadiosa *et al.* 2011)

[2.46] Pleurotaceae

Pleurotus dryinus (Pers.) P. Kumm on decaying tree trunk (Torres *et al.* 2020a, b)

**Pleurotus djamor* (Guerrero *et al.* 2020)

Pleurotus dryinus (Pers.) P. Kumm. (Torres *et al.* 2020b)

Pleurotus florida Singer (Reyes and Nair 2016)

Pleurotus opuntiae Lev. on branches (Tadiosa and Arsenio 2014)

Pleurotus ostreatus (Jacq. and Fr.) Kummer (Tadiosa and Arsenio 2014; Angeles *et al*. 2016; Reyes and Nair 2016; Arenas *et al.* 2018)

Pleurotus porrigens (Pers ex Fr.) P. Kumm. on decaying wood (de Leon *et al.* 2013a)

Pleurotus pulmonarius (fr.) Quel on wood of living trees (de Leon *et al.* 2013a)

Pleurotus sajor-caju (fr.) Singer wood of living trees (de Leon *et al.* 2013a)

[2.47] Pluteaceae

Pluteus umbrosus (Pers.) P. Kumm. on soil, and plant debris (Tadiosa *et al.* 2011)

Volvaria bresadolae Trotter (Go 1959; Quimio and Capilit 1981)

Volvaria esculenta Bres. (Clara 1937; Alicbusan and Ela 1960; Quimio and Capilit 1981)

Volvariella volvacea (Bull.) Singer on rotten leaves of banana (*Musa balbisiana*), and soil (Go 1959; Orillo and Carangal 1961; Quimio and Capilit 1981; Tadiosa *et al.* 2011; PNMCC 2012; de Leon *et al.* 2012, 2013a; Tadiosa and Briones 2013; Arenas *et al.* 2015; de Leon *et al.* 2015; Lazo *et al.* 2015; Angeles *et al*. 2016; Reyes and Nair 2016; Arenas *et al.* 2017; Culala and Dulay 2018; Tantengco and Ragragio 2018)

[2.48] Podoscyphaceae

Podoscypha bolleana (Mont.) Boidin on rotten trunk of *Albizzia* (Tadiosa *et al.* 2011)

Podoscypha brasiliensis D.A. Reid (de Leon *et al.* 2016)

Podoscypha petalodes (Berk.) Pat (Jusayan and Vicencio 2019; Guerrero *et al.* 2020)

Podoscypha subaffinis Boidin on rotten twigs of *Kleinhovia* (Tadiosa *et al.* 2011)

[2.49] Polyporaceae

Coriolus versicolor (L.) Quél on stumps (Tadiosa and Arsenio 2014; Arenas *et al.* 2018)

Daedaleopsis confragosa (Bolton) J. Schröt. on rotten branch of anabiong (*Trema orientalis*) (Arenas *et al.* 2015; Gaylan *et al.* 2018; Culliao *et al.* 2020)

Earliella scabrosa (Pers.) Gilb. and Ryvarden on tree trunks, rotten wood, and soil (Brazas *et al.* 2020; de Leon *et al.* 2021)

Favolus acervatus (Lloyd) Sotome and T. Hatt. Decaying log (de Leon *et al.* 2021)

Favolus alveolaris (DC.) Quél. on dead hardwoods (Brazas *et al.* 2020)

Favolus reniformis (Murrill) Sacc. and Trotter on rotten branch of tibig (*Ficus nota*) (Arenas *et al.* 2015; Angeles *et al*. 2016)

Fomes caryophylli (Racib) Bres on rotten stump of unknown tree and narra (*Pterocarpus indicus*) (Tadiosa and Arsenio 2014; Arenas *et al.* 2015, 2018)

Fomes fomentarius (L.) Fr. on rotten trunk of *Dillenia* (Tadiosa *et al.* 2011; de Leon *et al.* 2021)

Fomes gilvus (Schwein.) Lloyd. on rotten branch of molave (*Vitex parviflora*) (Tadiosa *et al.* 2007; Tadiosa and Briones 2013; Tadiosa and Arsenio 2014; Arenas *et al.* 2015, 2018; Angeles *et al*. 2016)

Fomes lamaoensis (Murrill.) Sacc. and Trotter on citrus (del Rosario 1968; Eusebio 1969; Quimio and Capilit 1981)

Fomes linteus (Burk. and Curt.) Cke. on stumps of ipil-ipil (*Leucaena leucocephal*a) (Tadiosa and Arsenio 2014)

Fomes lividus (Kalchbr. Ex Cooke) Sacc. (Eusebio 1969; Quimio and Capilit 1981)

Fomes noxius Corner on coconut (*Cocos nucifera*) (del Rosario 1967; Quimio and Capilit 1981)

Fomes pachyphloeus Pat. on trunk of narra (*Pterocarpus indicus),* and white lauan (*Shorea contorta* Vid.) (Tadiosa and Militante 2006; Tadiosa and Arsenio 2014)

Fomes senex (Nees. and Matt.) Cooke. on branches of kakawate (*Gliricidia sepium*) and white lauan (*Shorea contorta* Vid.) (Tadiosa and Militante 2006; Tadiosa and Arsenio 2014; Arenas *et al.* 2018)

Funalia polyzona (Pers.) Niemelä (Parlucha *et al.* 2021)

Hexagonia apiaria (Pers.) Fr. trunks (Tadiosa and Arsenio 2014; Arenas *et al.* 2015, 2018; Angeles *et al*. 2016)

Hexagonia glaber (P. Beauv.) Ryvarden on rotten branch of bayanti rotten wood (Tadiosa *et al.* 2011; Brazas *et al.* 2020)

Hexagonia nitida Durieu and Mont. rotten wood (Brazas *et al.* 2020)

Hexagonia tenuis (Hook.) Fr. on branches and twigs of trees, wood of living trees like dipterocarps, branch of *igyo*; in rotten branch of tara-tara (*Caesalpinia spinosa*) (Tadiosa and Militante 2006; Tadiosa *et al.* 2007, 2011; de Leon *et al.* 2013b; Tadiosa and Arsenio 2014; Arenas *et al.* 2015, 2018; Angeles *et al*. 2016; Liwanag *et al.* 2017; Brazas *et al.* 2020; Torres *et al.* 2020a, b)

**Lentinus auracariaceae* Hariot and Patouollard (Quimio 1977a; Quimio and Capilit 1981)

Lentinus cladopus Lev. on decaying wood (de Leon *et al.* 2013a)

Lentinus velutinus Fr. on soil and leaf litters (Brazas *et al.* 2020)

Lentinus sajor-caju (Fr.) Fr. on decaying log (PNMCC 2012; de Leon *et al.* 2012, 2013a; de Castro and Dulay 2015; Reyes and Nair 2016; Jacob *et al.* 2017; de Leon *et al.* 2018; Parlucha *et al.* 2021)

Lentinus squarrosulus Mont. on decaying wood (de Leon *et al.* 2013a)

Lentinus strigosus (Schwein.) Fr. on rotten root of malapapaya (*Polyscias nodosa*) (Arenas *et al.* 2015 Angeles *et al*. 2016; de Leon *et al.* 2021)

Lentinus tigrinus (Bull.) Fr. on decaying woods, and dried leaves (de Leon *et al.* 2012, 2013; Dulay *et al.* 2012; de Castro and Dulay 2015; Niem and Baldovino 2015; Jacob

et al. 2017; Nacua *et al.* 2018; Torres *et al.* 2020a)

Lenzites betulina branches and stump (Tadiosa and Arsenio 2014; Culliao *et al.* 2020)

Lenzites elegans (Spreng.) Pat. (de Leon *et al.* 2018; Gaylan *et al.* 2018; Torres *et al.* 2020; de Leon *et al.* 2021a)

Lenzites repanda (Pers.) Fr. rotten branch of guava (*Psidium guajava*) (Arenas *et al.* 2015; Angeles *et al*. 2016)

Lenzites striata (Fr.) Fr. on dipterocarps (Eusebio 1969; Quimio and Capilit 1981; Tadiosa and Militante 2006; Arenas *et al.* 2018)

Lenzites subferruginea Berk (Eusebio 1969; Quimio and Capilit 1981)

Microporus xanthopus (Fr.) Kuntze decaying tree branch (de Leon *et al.* 2021)

Microporus affinis (Blume and T. Ness.) Kuntze on rotten branches of guijo (*Shorea guiso*) and *Albizzia*, and rotting wood and trunk of trees on dipterocarps (Tadiosa and Militante 2006; Tadiosa *et al.* 2011; Tadiosa and Briones 2013; Tadiosa and Arsenio 2014; Arenas *et al.* 2015; Brazas *et al.* 2020)

Microporus flabelliformis (KI.) Fr. on dipterocarps (Tadiosa and Militante 2006)

Microporus incomptus (Afzel. ex Fr.) Kuntze on branches (Tadiosa and Arsenio 2014)

Microporus occidentalis (Klotzsch) Kuntze on trunks (Tadiosa and Reyes 2020)

Microporus subaffinis (Lloyd) Imazeki (Torres *et al.* 2020b)

Microporus vernicipes (Berk.) Imazeki on trunk of *Macaranga* (Tadiosa *et al.* 2011; Tadiosa and Briones 2013; Liwanag *et al.* 2017)

Microporus xanthopus (Fr.) Kuntze on rotten branches of mala-mangga (*Mangifera indica*), woody substrate, decaying log, and rotten branches of *Aglaia*, on red lauan (*Shorea negrosensis* Foxw.) and other dipterocarps (Tadiosa and Militante 2006; Tadiosa *et al.* 2011; Tadiosa and Briones 2013; Tadiosa and Arsenio 2014; Arenas *et al.* 2015, 2018; Niem and Baldovino 2015; Angeles *et al*. 2016; Liwanag *et al.* 2017; Gaylan *et al.* 2018; Guzman *et al.* 2018; Brazas *et al.* 2020; Paguirigan *et al.* 2020; Torres *et al.* 2020a, b; Parlucha *et al.* 2021)

Polyporus badius (Pers.) Schwein on woody substrate (Brazas *et al.* 2020; Parlucha *et al.* 2021)

Polyporus cuticularis (Bull.) Fr. on barks (Tadiosa and Arsenio 2014)

Polyporus durus Jungh. on rotten branch of *narra* (*Pterocarpus indicus*) (Arenas *et al.* 2015)

Polyporous grammocephalus Berk. (Tadiosa and Briones 2013; de Leon *et al.* 2013a; Tadiosa and Arsenio 2014; Arenas *et al.* 2018)

Polyporus gilvus (Schwein.) Fr. on rotten branch of katmon (*Dillenia philippinensis*) (Tadiosa and Arsenio; Arenas *et al.* 2015)

Polyporus hirsutus (Wulfen) Fr. on rotten branch of tara-tara (*Caesalpinia spinosa*) (Tadiosa and Arsenio 2014; Arenas *et al.* 2015, 2018; Liwanag *et al.* 2017)

Polyporus picipes Fr. (Tadiosa *et al.* 2007; Arenas *et al.* 2018; Torres *et al.* 2020a, b)

Polyporus pinistus Fr. (Tadiosa and Arsenio 2014; Arenas *et al.* 2018; Gaylan *et al.* 2018)

Polyporus roseus (Alb and Schwein.) Fr. on rotten branch of narra (*Pterocarpus indicus*) (Arenas *et al.* 2015)

Polyporus flavus Jung. (Eusebio 1969; Quimio and Capilit 1981)

Polyporus grammocephalus Berk. on decaying wood (de Leon *et al.* 2013a)

**Polyporus maximus* (Mont.) Overh. (Eusebio 1969; Quimio and Capilit 1981)

Polyporus rubidus Berk. (Eusebio 1969; Quimio and Capilit 1981)

Polyporus sanguineus (L.) G. Mey. on decaying log, and dipterocarps (Eusebio 1969; Quimio and Capilit 1981; Tadiosa and Militante 2006; Tadiosa and Briones 2013; Tadiosa and Arsenio 2014; Jacob *et al.* 2017)

Polyporus semilaccatus Berk. on dipterocarps (Tadiosa and Militante 2006)

Polyporus varius (Persoon) Fries (Paguirigan *et al.* 2020)

Polyporus versatilis (Berk.) Romell (Eusebio 1969; Quimio and Capilit 1981)

Polystictus xanthopus Fr. on white lauan (*Shorea contorta* Vid.) (Tadiosa and Militante 2006; Tadiosa *et al.* 2007; de Leon *et al.* 2013b)

Poria latemarginata (Durieu and Mont.) Cooke on branches (Tadiosa and Arsenio 2014)

**Poria medulla* (Jacg.) Bres. > *Poria medulla-panis* (Jacq.) Pers. (Eusebio 1969; Quimio and Capilit 1981)

Poria straminea Bres. on red *lauan* (*Shorea negrosesnsis* Foxw.) (Mendoza and Arenas 1966; Eusebio 1969; Quimio and Capilit 1981; Tadiosa and Militante 2006)

Poria tricolor Bres (Mendoza and Arenas 1966; Eusebio 1969; Quimio and Capilit 1981)

Pycnoporus sanguineus (L.) Murr. on rotten trunk of *Shorea* (Tadiosa *et al.* 2011; de Leon *et al.* 2013b; Angeles *et al*. 2016; Liwanag *et al.* 2017; Arenas *et al.* 2018;

Paguirigan *et al.* 2020; Torres *et al.* 2020a, b; de Leon *et al.* 2021)

Spongipellis pachyodon (Pers.) (Jusayan and Vicencio 2019)

Trametes aspera (Jungh.) Bres. Rotten stump of mahogany (*Swietenia macrophylla*) (Eusebio 1969; Quimio and Capilit 1981; de Leon *et al.* 2013b; Tadiosa and Arsenio 2014; Arenas *et al.* 2015; Jacob *et al.* 2017; Nacua *et al.* 2018

Trametes cervina (Schwein.) Bres. decaying wood (de Leon *et al.* 2013b)

Trametes corrugata (Pers.) Bres. rotten trunk of alibangbang (*Bauhinia purpurea*), and dipterocarps (Eusebio 1969; Quimio and Capilit 1981; Tadiosa and Militante 2006; Tadiosa and Briones 2013; Arenas *et al.* 2015, 2018; Angeles *et al*. 2016; Liwanag *et al.* 2017)

Trametes elegans (Spreng.) Fr. decaying log (Jacob *et al.* 2017; de Leon *et al.* 2018; Guzman *et al.* 2018; Torres *et al.* 2020b; de Leon *et al.* 2021)

Trametes gibbosa (Pers.) Fr. living tree (de Leon *et al.* 2021)

*Trametes hirsuta (*Wulfen) Lloyd on decaying log and hardwood (Eusebio 1969; Quimio and Capilit 1981; Jacob *et al.* 2017; Paguirigan *et al.* 2020; de Leon *et al.* 2021)

Trametes insularis Murrill (Eusebio 1969; Quimio and Capilit 1981)

Trametes lactinea (Berk.) Sacc. (Eusebio 1969; Quimio and Capilit 1981)

Trametes membranacea on decaying palm (Guerrero *et al.* 2020)

Trametes muelleri Berk. (Eusebio 1969; Quimio and Capilit 1981)

Trametes ochracea (Persoon) Gilbertson and Ryvarden (Paguirigan *et al.* 2020)

**Trametes raseola* Pat. (Eusebio 1969; Quimio and Capilit 1981)

Trametes ochracea (Pers.) Gilb and Ryvarden on decaying logs and woods (Brazas *et al.* 2020)

Trametes versicolor (L.:Fries) Pilt dead wood Wood of living trees stump of akleng-parang (*Albizia procera*) (Sibounnavong *et al.* 2008; de Leon *et al.* 2013b; Tadiosa and Briones 2013; Arenas *et al.* 2015, 2018; de Leon *et al.* 2021; Kim *et al.* 2021)

Trichaptum abietinum (Pers. ex J.F. Gmel.) Ryvarden on rotten branch of alibangbang (*Bauhinia purpurea*) (Arenas *et al.* 2015)

Tyromyces chioneus (Fries) P. Karsten (Paguirigan *et al.* 2020)

[2.50] Psathyrellaceae

Coprinellus micaceus (Bull.) Vilgalys, Hopple and Jacq. on soil and woody substrate (Tadiosa and Briones 2013; Brazas *et al.* 2020)

Coprinellus disseminatus (Pers.) JE Lange (de Leon *et al.* 2018; Torres *et al.* 2020a, b; Guerrero *et al.* 2020; de Leon *et al.* 2021)

Coprinopsis atramentaria (Bull.) Redhead on soil (Torres *et al.* 2020a, b)

Coprinopsis clastophylla (Maniotis) Redhead (Guerrero *et al.* 2020)

Coprinopsis lagopus (Fr.) Redhead,Vilgalys and Moncalvo on soil (Torres *et al.* 2020a, b)

Panaeolus antillarum (Fr.) Dennis on soil (Culala and Dulay 2018)

Panaeolus cyanescens (Berk and Broome) Sacc. dung (de Leon *et al.* 2021)

Panaeolus papilionaceus (Bull.) Quél. on wood and pastures (Brazas *et al.* 2020; de Leon *et al.* 2013b)

Panaeolus semiovatus (Sowerby) S. Lundell and Nannf. on soil (grassland) (Arenas *et al.* 2015)

Parasola plicatilis (Curtis) Redhead, Vilgalys and Hopple on soil (Guerrero *et al.* 2020; de Leon *et al.* 2021)

Psathyrella candolleana (Fr.) Maire on soil (Jacob *et al.* 2017; de Leon *et al.* 2021; Kim *et al.* 2021)

[2.51] Pterulaceae

Deflexula fascicularis (Bres. and Pat.) Corner (Dogma 1966a; Quimio and Capilit 1981)

Deflexula subsimplex (Henn.) Corner (Dogma 1966a; Quimio and Capilit 1981)

Pterula intermedia Dogma (Dogma 1966a; Quimio and Capilit 1981)

Pterula taxiformis Mont. (Dogma 1966a; Quimio and Capilit 1981)

Pterula verticillata Corner (Dogma 1966a; Quimio and Capilit 1981)

Pterulicium xylogenum (Berk and Broome) Corner (Dogma 1966a; Quimio and Capilit 1981)

[2.52] Russulaceae

Lactarius piperatus (L.) Pers. on soil and woody substrate (Arenas *et al.* 2015, 2018; Angeles *et al*. 2016; Brazas *et al.* 2020)

Lactarius plumbeus (Bull.) Gray on woody substrate (Brazas *et al.* 2020)

Lactarius trvialis (Fr.) Fr. (Tadiosa and Briones 2013)

Lactifluus piperatus (L.) Kuntze on decaying leaves (Nacua *et al.* 2018)

Russula emetica Fr. (Arenas *et al.* 2018)

Russula mariae Peck (Parlucha *et al.* 2021)

Russula virescens (Schaeff.) Fr. (de Leon *et al.* 2016; Parlucha *et al.* 2021)

[2.53] Schizophyllaceae

Schizophyllum commune Fr. on cotton, rotten branch of golden shower (*Cassia fistula*), decaying wood/log, and dipterocarps (Celino 1936; Quimio and Capilit 1981; Tadiosa and Militante 2006; Tadiosa *et al.* 2007; de Leon *et al.* 2012, 2013b; Tadiosa and Briones 2013; Tadiosa and Arsenio 2014; Arenas *et al.* 2015, 2017, 2018; de Castro and Dulay 2015; de Leon *et al.* 2015, 2018, 2021; Lazo *et al* 2015; Niem and Baldovino 2015; Angeles *et al*. 2016; Jacob *et al.* 2017; Liwanag *et al.* 2017; Tantengco and Ragragio 2018; Brazas *et al.* 2020; Paguirigan *et al.* 2020; Torres *et al.* 2020a, b; Parlucha *et al.* 2021)

[2.54] Sclerodermataceae

**Pisolithus tenius* E. Fisher (Reynolds 1967; Quimio and Capilit 1981)

**Pisolithus tuberosum* (Mich.) Fr. (Reynolds 1967; Quimio and Capilit 1981)

Scleroderma aurantiacum Pers. Ex Sacc. (Reynolds 1967; Quimio and Capilit 1981)

Scleroderma bovista Fr. (Reynolds 1967; Quimio and Capilit 1981)

Scleroderma citrinum Pers. (Culliao *et al.* 2020; de Leon *et al.* 2013b, 2016)

Scleroderma dictyosporum Pat. (Reynolds 1967; Quimio and Capilit 1981)

Scleroderma flavocrocatum Sacc. and de Toni (Reynolds 1967; Quimio and Capilit 1981)

Scleroderma verrucosum (Bull.) Pers. (Reynolds 1967; Quimio and Capilit 1981)

[2.55] Sphaerobolaceae

Sphaerobolus stellatus Tode on carabao dung (Reynolds 1967; Quimio and Capilit 1981; de Leon *et al.* 2013b)

[2.56] Stereaceae

Stereum complicatum (Fr.) Fr on rotten branch of *guijo* (*Shorea guiso*) (Arenas *et al.* 2015; Angeles *et al*. 2016; Parlucha *et al.* 2021)

Stereum hirsutum (Willd.) Pers. on decaying woods/log (Guzman *et al.* 2018; Nacua *et al.* 2018; Torres *et al.* 2020a, b)

Stereum insignatum Blume. (Tadiosa and Briones 2013)

Stereum lobatum (Kunze and Fr.) Fr. on decaying log (Torres *et al.* 2020a, b)

Stereum ostrea (Blume and T. Nees.) Fr. on decaying woods and rotten branch of pagsahingin (*Canarium asperum*) (Tadiosa and Arsenio 2014; Arenas *et al.* 2015, 2018; Nacua *et al.* 2018; Torres *et al.* 2020a, b)

Stereum rugosum Pers. on rotten stump of alibangbang (*Bauhinia purpurea*) (Arenas *et al.* 2015; Paguirigan *et al.* 2020)

Stereum sanguinolentum (Alb. and Schwein.) Fr. on rotten stump of unknown tree (Arenas *et al.* 2015; Angeles *et al*. 2016)

Stereum submentosum Pouzar (Paguirigan *et al.* 2020)

[2.57] Strophariaceae

Hebeloma mesophaeum (Pers.) Quél. on soil (Brazas *et al.* 2020)

Hypholoma fasciculare (Huds.) P. Kumm. on soil (Arenas *et al.* 2015; Angeles *et al*. 2016)

Stropharia rugosoannulata (Farlow) Murr on rotten root of yemane (*Gmelina arborea*) (Arenas *et al.* 2015, 2018)

Stropharia semiglobata (Batsch) Quél. on decaying leaf (Brazas *et al.* 2020; de Leon *et al.* 2013b)

[2.58] Thelephoraceae

Thelephora terrestris Ehrh. on rotten root of bignay (*Antidesma bunius*) (Tadiosa and Arsenio 2014; Arenas *et al.* 2015; Angeles *et al*. 2016)

[2.59] Tremellaceae

Tremella fuciformis Berk. on rotten trunk of batino (*Alstonia sholaris*) (PNMCC 2012; Arenas *et al.* 2015, 2018; Angeles *et al*. 2016; Paguirigan *et al.* 2020)

[2.60] Tricholomataceae

Clavicorona candelabrum (Massee) Corner (Dogma 1966b; Quimio and Capilit 1981)

Clavicorona javanica (Sacc. and Syd.) Corner (Dogma 1966b; Quimio and Capilit 1981)

Clitocybe dealbata (Sowerby) P. Kumm. on grassy habitat (Brazas *et al.* 2020)

Clitocybe nebularis (Batsch) P. Kumm. (Santos and Bernardo 1966; Quimio and Capilit 1981)

Collybia albuminosa (Berk.) Petch (Quimio and Suayan 1976; Quimio and Capilit 1981)

Collybia maculata (Alb.and Schwein.) P. Kummer on soil (Arenas *et al.* 2015; Angeles *et al*. 2016)

Collybia dryophila (Bull.) P. Kumm. (Santos and Bernardo

1966; Quimio and Capilit 1981)

Tricholoma flavovirens Lundell, S.; Nannfeldt, J.A. on soil (Culala and Dulay 2018)

Tricholoma lascivum (Fries) Gillet (Paguirigan *et al.* 2020)

Tricholoma saponaceum (Fr.) P. Kumm (Arenas *et al.* 2018)

Incertae sedis

Panaeolus papilionaceus (Bull.) Quél. decaying leaves (Nacua *et al.* 2018)

DISCUSSION

This checklist of macrofungi reported for the Philippines includes 402 entries. The current Philippine macrofungi list comprises 376 validated species, excluding published names. Among the validated species, the Philippine macrofungi were classified into Ascomycota with 10 families, 13 genera, and 19 species plus Basidiomycota with 56 families, 117 genera, and 357 species. Of the 66 taxonomic families, most families have only one recorded genus. Family Polyporaceae has 20 genera with 83 species, whereas 10 with 32 species were identified as Agaricaceae. The top 10 families under each phylum with a high number of reported species of macrofungi in the country are shown in Table 1. Several minor collections support this data in the country, including the collection done by Jacob *et al.* (2017) at Isabela State University with Ganodermataceae, and Polyporaceae having the most abundant species. *Auricularia polytricha*, *Pycnoporous sanguineus*, *Podoscypha* sp., *Auricularia auricula*, *Schizophyllum commune*, *Trametes hirsuta*, *Marasmius* sp., and *Coprinus* sp. were among the macrofungi collected. *Auricularia polytrichia*, *Schizophyllum communae,* and *Mycena* sp. were reported in Mt. Nagpale in Abucay, Bataan (Tayamen *et al.* 2004). Moreover, a total of 20 species in Mount Makiling Forest Reserve, Los Banos Laguna, was observed by de Castro and Dulay (2015). The taxonomical distribution of macrofungi in this checklist corroborated with the study reported by Priyamvada *et al.* (2017) in southern India, where a total of 113 macrofungal species comprise Basidiomycota (96%) and Ascomycota (4%) classified under Agaricaceae (25.3%), Polyporaceae (15.3%), and Marasmiaceae (10.8%) were observed. Also, in Cambodia, 3,950 mushrooms belonging to phylum Ascomycota with 26 species and phylum Basidiomycota with 276 species were collected from 2009–2014. Among these macrofungi, the most species-rich families are Polyporaceae, Marasmiaceae, Ganodermataceae, Hymenochaetaceae, and Mycenaceae (Kim *et al.* 2017), comparable to the Philippine records. Compared with the reported macrofungi in other Asian countries, the Philippine macrofungal studies may be considered in its static condition or slow rate of development. These results could also be attributed to the role of climate and the season of collection (Paul *et al*. 2019). During the rainy season, when mushrooms are abundant, fleshy mushrooms could be damaged because of too much moisture in the environment, mainly leaving the Polypore fungi with a more complex structure (Seelan *et al.* 2015). Records of macrofungal species in the Philippines showed a slow increment of 156 species in 1906 to its current verified number of 376, thereby adding only 220 species within a century. This is translated to a discovery rate of two species per year, a rather "distressing" rate in a country known for its megadiversity.

Looking at the sampling localities where most of the macrofungal species in the country were collected, several species may await discovery in many of the unexplored areas in the country. This is expected given that the Philippines is one of the megadiverse countries in the region. As shown in Figure 1, most of the collection sites were from Luzon Island, leaving Visayas and Mindanao region out of the records. To support this claim, Mueller *et al.* (2007) – in their compilation of the global status of macrofungal diversity and its distribution, tropical Asia, including the Philippines – recorded only 400 taxon names, with 43% unique names for the region. A small percentage of macrofungal flora has been described, and a majority of these are found in temperate countries (Kinge *et al*. 2020; Hawksworth and Lücking 2017). Tropical countries – such as the Philippines, with a known high diversity of macrofungi – have not been fully described and explored because of a low number of trained mycologists, as well as taxonomic discrepancy (Kinge *et al*. 2020; Hawksworth 2001).

Records of published journal articles show only a few macrofungal species in the last 15 years. Based on our records, the highest number of published macrofungal species was in 2015 with 116 recorded species, whereas the least number of species ever recorded from 2005–2020 was in 2016, when only three species of basidiomycetes were recorded and published. In addition, the low number of published monographs – as well as extensive and long-term taxonomic surveys on Philippine macrofungal biodiversity – also prevents conclusive ecological diversity assessments (Kinge *et al*. 2020; Torres *et al.* 2020). Conclusive questions, such as those of the diversity of macrofungal species in one type of forest (as compared to another) in one or two provinces, can often not be answered. This could also be due to the challenges that mycology faces in the Philippines, where it lacks positive reception within state universities and private higher educational institutions (de la Cruz *et al.* 2013).

The importance of macrofungi is well recognized because of their ecological and therapeutic importance. However,

information on their diversity is still scanty due to a few taxonomic surveys, as well as few relevant and updated checklists and monographs of macrofungal biodiversity in the Philippines. This causes biases in ecological and diversity assessment and ignorance to the public and policymakers. In addition, the lack of a readily available checklist and information on the general importance, diversity, and ecological functions of macrofungi in the Philippine ecosystem can impede the country's overall regulations set for critical fungal resources and their respective quarantine protocols (Kinge *et al.* 2020; Torres *et al.* 2020a). The current checklist provides an overview of the macrofungal diversity in the Philippines. Also, the checklist will be of great benefit to address significant gaps in the overall knowledge and collection of Philippine fungal biodiversity and will be helpful to different regulatory authorities for policymaking. The checklist will provide baseline information that can be used to identify and compile a red list of Philippine macrofungi based on the criteria given by the International Union for the Conservation of Nature and set guidelines for the conservation and protection of these essential fungal resources (Gryzenhout 2015). The checklist can also be used to identify the residency status (endemic, invasive, and neutralized) of a certain macrofungal species (Kinge *et al.* 2020; Gryzenhout 2015) and aid in identifying the indicator fungal species that can be used to monitor ecological change and integrity of a specific ecosystem in the Philippines. Finally, the checklist will be of great help to know the direction of future research in the collection, survey, and a description of novel strains of macrofungi, which will allow collaborations among local and international scientists making the study of Philippine macrofungi more accessible and transparent. Thus, a need to support the training of the next generation of Filipino mycologists and increase the appreciation of fungi by the scientific community and public in the Philippines. Published journal articles show only a few macrofungal species in the last 15 years. Based on our records, the highest number of published macrofungal species was in 2015 with 116 recorded species, whereas the least number of species ever recorded from 2005–2020 was in 2016, when only three species of Basidiomycetes were recorded and published. In addition, the low number of published monographs – as well as extensive and long-term taxonomic surveys on Philippine macrofungal biodiversity – also prevents conclusive ecological diversity assessments (Kinge *et al.* 2020; Torres *et al.* 2020a). Conclusive questions, such as those of the diversity of macrofungal species in one type of forest (as compared to another) in one or two provinces, can often not be answered. This could also be due to the challenges that mycology faces in the Philippines, where it lacks positive reception within state universities and private higher educational institutions (de la Cruz *et al.* 2013).

CONCLUSION

The study provided a preliminary checklist of macrofungi reported from the Philippines based on published journals and the current opportunities in macrofungal research. The Philippines has a total of 376 validated species of macrofungi classified under 66 families and 130 genera. Most species belong to Ascomycota and Basidiomycota. Records showed that most families of fungi collected were under Agaricaceae, Lycoperdaceae, Marasmiaceae, and Polyporaceae. However, study sites were concentrated on Luzon Island, leaving Visayas and Mindanao unexplored. These challenges could be attributed to the lack of interest by the researchers in the field, preventing conclusive ecological diversity assessments. While this study intends to raise opportunities brought by challenges, traditional morphological and taxonomical identification research must be backed-up with molecular systematics and biotechnology in identifying and classifying these organisms that will further enhance the Philippines' mushroom research.

STATEMENT ON CONFLICT OF INTEREST

The authors declare no conflict of interest.

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