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SPECIES LISTING OF NATURALLY OCCURRING MUSHROOMS IN AGRO-ECOSYSTEM OF BARANGAY BAMBANABA, CUYAPO, NUEVA ECIJA, PHILIPPINES

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ABSTRACT

In this paper we reported the different naturally occurring mushrooms in agro-ecosystem of Brgy. Bambanaba, Cuyapo, Nueva Ecija. Philippines. Mushrooms were collected in June 2016 from the four sites namely; Bagatan, Amianan, Laod, and Daya. Specimens were identified based on their micro- and macro-morphological characteristics. A total of 30 identified species were classified under 18 families and 21 genera. Eleven leaf litter-, soil-, and dung-decomposing mushrooms including *Amanita onusta*, *Panaeolus semiovatus*, *Coprinus comatus*, *Coprinellus micaceus*, *Coprinus plicatilis*, *Chlorophyllum molybdites*, *Termitomyces clypeatus*, *Dictyophora indusiata*, *Volvariella volvacea*, *Psilocybe coprophila*, and *Marasmius oreades* were listed. However, 19 wood-rotting mushrooms such as *Auricularia auricular-judae*, *Auricularia polytricha*, *Dacryopinax spathularia*, *Ganoderma lucidum*, *Ganoderma neo-japonicum*, *Ganoderma sinense*, *Ganoderma* sp., *Phellinus linteus*, *Pleurotus cystidiosus*, *Pleurotus djamor*, *Pleurotus* sp., *Coriolus versicolor*, *Fomitopsis* sp., *Lentinus tigrinus*, *Polyporus grammocephalus*, *Schizophyllum commune*, *Stereum hirsitum*, *Tremella foliacea*, and *Tremella*

mesenterica were recorded. Most of these naturally occurring mushrooms were edible and have been reported to exhibit promising medicinal properties.

Keywords: Brgy. Bambanaba, agro-ecosystem, macrofungi, basidiomycetes, leaf-litters, wood-rotters

INTRODUCTION

Mushrooms are macrofungi with distinctive fruiting body, which can be hypogeous or epigeous, large enough to be seen with the naked eye and to be picked by hand **[1]**. They are ubiquitous, they can grow naturally on lingo-cellulosic substrates. Macrofungi are considered decomposers of wide variety of plant wastes and residues in the natural ecosytems. Moreover, they can be valuable food and alternative medicines for the people if their promising potentials are properly harnessed. Mushrooms, in general, are rich source of protein, carbohydrate, crude fiber, vitamins, minerals, functional fatty acid, amino acids, and bioactive mycochemicals **[2, 3, 4, 5]**. Mushrooms have shown a number of biological activities such as antitumour, antiviral, antibiotic, hypoglycaemic, hypocholesterolemic, hypotensive, and anti-inflammatory activities **[6, 7]**.

The Philippines is a haven of naturally occurring mushrooms with nutraceutical and medicinal properties. However, only few species are utilized for massive production including *Volvariella volvacea*, *Auricularia* species, and *Ganoderma lucidum*. Introduced species such as *Pleurotus florida* and *Lentinula edodes* are also cultivated in different parts of the country. Thus, there is a need to search for more mushroom species from the wilderness and develop their production technology in order to multiply the number of cultivated mushrooms in the Philippines.

Barangay Bambanaba is one of the barangays in the municipality of Cuyapo in Nueva Ecija, Central Luzon. It is approximately located at 162 km north of Manila. This area is known for wide agro-ecosystems, which has spacious vegetation comprising trees and agricultural crops, thus, generates vast agricultural waste and plant litters. These substrates and the fine climatic conditions in the area favor the proliferation of diverse mushroom species. Therefore, hunting and collection of edible naturally occurring mushrooms are also being practiced by farmers as source of food and additional income.

Herein, we reported the different naturally occurring mushrooms from the four

collection sites in agro-ecosystem of Brgy. Bambanaba, Cuyapo, Nueva Ecija. Specimens were identified and classified based on their morphological characteristics. The description, local name, edibility, substrate, and location of each collected mushroom were summarized in a taxonomic checklist.

MATERIALS AND METHODS

Study Site

The study site was in the agro-ecosystem of Brgy. Bambanaba, Cuyapo, Nueva Ecija, Philippines. The area is located approximately 162 km north of Manila and has a temperature range from 25°C to 27°C and a relative humidity range from 50% to 70%. Four (4) collection sites within the agro-ecosystem were selected namely; Bagatan, Amianan, Laod, and Daya. These sites were considered due to vast vegetation and availability of mushrooms. The topographic map and the four collection sites are shown in Figure 1.

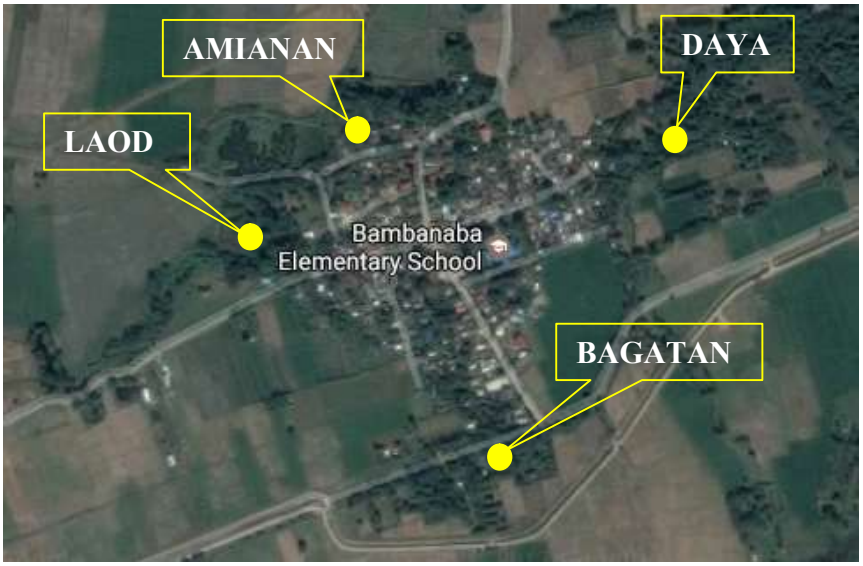

Figure 1: Topographic map of Brgy. Bambanaba, Cuyapo, Nueva Ecija and the four collection sites

Mushroom Collection

Survey and collection of all mushrooms were done in June 2016. Mushrooms were photo-documented in their natural habitat and were carefully collected using shovel obtaining part of the substrate to ensure that they were not damaged. Specimens were properly labeled and individually placed in a brown paper bag and brought to the laboratory for identification.

Morphological Characterization and Identification

Mushrooms were identified and taxonomically classified based on the

Peterson Field Guides on Mushrooms by McKnight and McKnight **[8]**. Morphometric data such as the shape of the fruiting body and the cap, gills in section, textures and colors together with the measurement of the cap or pileus (diameter and height), stalk or stipe (width and height), and bracket thickness were gathered while spore shape, size and colour were observed. A taxonomic checklist with description, local name, edibility, substrate, and location of identified mushrooms was prepared.

RESULTS AND DISCUSSION

Mushrooms are essential not only in the environment but also in human. They can be valuable resource of food and medicines. In this study, the different wild mushrooms growing in the agro-ecosystem of Brgy. Bambanaba, Cuyapo, Nueva Ecija were assessed and documented, in our intention to discover more mushrooms with cultivation potential. A total of 30 mushroom species were collected and identified from the four collection sites in the study area and they were under 18 families and 21 genera. The description, local name, edibility, substrate, and location of each identified mushroom were listed in a taxonomic checklist. The checklist was divided into two groups of mushrooms, the leaf litter-, soil-, dung-decomposing mushrooms and the wood-rotting mushrooms. The photo-document of the different mushrooms in their natural habitat is presented in Figure 2 and Figure 3.

The present study found that there were 11 leaf litter-, soil-, dung-decomposing mushrooms and 19 wood-rotting mushrooms inhabiting the study area. The different leaf litter-, soil-, and dung-decomposing mushrooms include *Amanita onusta*, *Panaeolus semiovatus*, *Coprinus comatus*, *Coprinellus micaceus*, *Coprinus plicatilis*, *Chlorophyllum molybdites*, *Termitomyces clypeatus*, *Dictyophora indusiata*, *Volvariella volvacea*, *Psilocybe coprophila*, and *Marasmius oreades* whereas the wood-rotting mushrooms were *Auricularia auricular-judae*, *Auricularia polytricha*, *Dacryopinax spathularia*, *Ganoderma lucidum*, *Ganoderma neo-japonicum*, *Ganoderma sinense*, *Ganoderma* sp., *Phellinus linteus*, *Pleurotus cystidiosus*, *Pleurotus djamor*, *Pleurotus* sp., *Coriolus versicolor*, *Fomitopsis* sp., *Lentinus tigrinus*, *Polyporus grammocephalus*, *Schizophyllum commune*, *Stereum hirsitum*, *Tremella foliacea*, and *Tremella mesenterica*. All these mushrooms belong to Basidiomycota. Three mushrooms were identified down to genus level only while 27 mushrooms were identified down to species level.

Among 18 families, Polyporaceae and Ganodermataceae have the most number of collected species. Four genera were noted under Polyporaceae including *Coriolus*, *Fomitopsis*, *Lentinus*, and *Polyporus* whereas only genus *Ganoderma* with four species was found under Ganodermataceae. Most of the mushrooms were collected from Daya (33.33%), followed by Bagatan (26.67%) and Amianan (23.33%). Laod had the least number of collected specimens (16.67%), probably due to the low vegetation in this site. Most of the mushrooms have specific local name, suggesting that people in the community were familiar to the identity of mushrooms. Three species were generally called as "oong" (Ilocano term for mushroom) while 4 species were no assigned local name. Among the 30 collected species, 18 species of the mushrooms were found edible while 2 species were edible but not much valued. Six species were not recommended and 2 species were inedible. However, there were 2 poisonous species in the list namely, *C. molybdites* and *A. onusta*. Moreover, five jelly mushrooms were also recorded and these were *A. auricular-judae*, *A. polytricha*, *D. spathularia*, *T. foliacea*, and *T. mesenterica*.

Leaf Litter-, Soil-, Dung-Decomposing Mushrooms
Amanitaceae
***Amanita onusta* (Howe) Sacc. (1891)**
Description : Pileus is crowded with gray-brown irregularly shaped warts. It has unpleasant odor. (Figure 2A)
Local Name : *Oong*
Edibility : poisonous
Substrate : soil with leaf litters
Location : Amianan
Bolbitaceae
***Panaeolus semiovatus* (Sowerby) S. Lundell & Nannf. (1983)**
Description : White to yellowish shiny bell-shaped pileus with black gills. It has long hollow stipe. (Figure 2B)
Local Name : *Oong tak-ki nwang*
Edibility : edible
Substrate : carabao dung
Location : Bagatan
Coprinaceae
***Coprinus comatus* (O.F. Müll.) Pers. (1797)**
Description : Medium size cylindrical white fibrillose pileus. The stipe has loose ring at young stage. (Figure

2C)
Local Name : *Oong malem*
Edibility : edible at young and not recommended when mature
Substrate : decomposing mungbean hull
Location : Laod
***Coprinellus micaceus* (Bull.) Vilgalys, Hopple, & Jacq Johnson (2001)**
Description : Very thin, light brownish pileus, with long streaks on surface. Thin whitish stalk. Pileus is covered with a thin layer of glistening powder at first. Grows in dense clumps. (Figure 2D)
Local Name : *Oong*
Edibility : not recommended
Substrate : soil
Location : Bagatan
***Coprinus plicatilis* (Curtis) Fr. (1838)**
Description : Small gray wrinkled pileus; very thin fragile. Long thin fragile stipe. (Figure 2E)
Local Name : *Oong sabong*
Edibility : not recommended
Substrate : grassy soil
Location : Daya
Lapiotaceae
***Chlorophyllum molybdites* (G. Mey.) Massee (1898)**
Description : Large white pileus, have pinkish brown tinge on the center of the pileus and on tips of scales. The stipe is slender. (Figure 2F)
Local Name : *Oong*
Edibility : poisonous
Substrate : grassy soil
Location : Laod
Lyophyllaceae
***Termitomyces clypeatus* R. Heim (1951)**
Description : Umbo-shaped grayish to brown succulent pileus with pinkish spores. (Figure 2G)
Local Name : *Oong bunton*
Edibility : edible
Substrate : termites mound
Location : Daya
Phallaceae
***Dictyophora indusiata* (Vent.) Desv. (1809)**
Description : Medium size fruiting body with veil-like skirt originating under the bell-shaped slime-covered pileus. It has white spongy stipe. (Figure 2H)
Local Name : *Oong belo*
Edibility : edible
Substrate : clay soil near bamboo
Location : Daya

Plutaceae
***Volvariella volvacea* (Bull.) Singer (1951)**
Description : Fruiting body is round to egg-shaped at young and has bell-shaped fibrillose pileus attached to shiny white stipe arises from membranous sheath called volva. (Figure 2I)
Local Name : *Oong saba / Oong garami*
Edibility : edible
Substrate : decomposing pile of rice straw
Location : Daya
Strophariaceae
***Psilocybe coprophila* (Bull.) P.Kumm. (1871)**
Description : Small dark reddish brown, rounded, smooth pileus. Slender fibrillose, pallid to brownish stipe. (Figure 2J)
Local Name : *Oong tak-ki*
Edibility : not recommended
Substrate : composted dried dung
Location : Amianan
Tricholomataceae
***Marasmius oreades* (Bolton) Fr. (1836)**
Description : The pileus is bell-shaped to flat when matures with brown to yellowish color attached to rigid and slender stipe. (Figure 2K)
Local Name : *Oong ru-ot*
Edibility : inedible
Substrate : grassy soil
Location : Amianan
Wood-Rotting Mushrooms
Auriculariaceae
***Auricularia auricular-judae* (Bull.) J. Schröt (1888)**
Description : Small to medium rubbery fruiting body with ear lobe shaped. (Figure 3A)
Local Name : *Oong lapayag*
Edibility : edible
Substrate : fallen branch wood of mango tree
Location : Bagatan
***Auricularia polytricha* (Mont.) Sacc. (1885)**
Description : The flesh is tough and woody or cork-like, and brown in color and has yellowish-brown hyphae. (Figure 3B)
Local Name : *Oong lapayag*
Edibility : edible
Substrate : living trunk of neem tree
Location : Daya
Dacrymycetaceae

***Dacryopinax spathularia* (Schwein.) G.W. Martin (1948)**
Description : The fruit bodies are yellow-orange to orange, gelatinous, have rounded stalks at the base, and are flattened upward shaped like fan. (Figure 3C)
Local Name : None
Edibility : not recommended
Substrate : dead cut tree
Location : Bagatan
Ganodermataceae
***Ganoderma lucidum* (Curtis) P. Karst (1881)**
Description : It has corky, flat, kidney-shaped cap with a red-varnished at the middle and white margin at young. (Figure 3D)
Local Name : *Oong kayu*
Edibility : edible
Substrate : living root of mango tree
Location : Daya
***Ganoderma neo-japonicum* Imazeki (1939)**
Description : Medium size, flat woody, reddish brown fan-shaped bracket. It has long stipe. (Figure 3E)
Local Name : *Oong kayu*
Edibility : edible
Substrate : living roots of ipil-ipil tree
Location : Daya
***Ganoderma sinense* J.D. Zhao, L.W. Hsu, & X.Q. Zhang (1979)**
Description : Medium to large, flat corky, brown to black fruiting body (Figure 3F)
Local Name : *Oong kayu*
Edibility : edible
Substrate : living roots of tree
Location : Amianan
***Ganoderma* sp.**
Description : Large woody bracket semicircular shaped with dull crust pileus upper surface. (Figure 3G)
Local Name : *Oong kayu*
Edibility : not recommended
Substrate : living trunk of guava tree
Location : Bagatan
Hymenochaetaceae
***Phellinus linteus* (Berk., & M.A. Curtis) Teng (1963)**
Description : Medium to large, thick, brownish to black, and shaped like a hoof(Figure 3H)
Local Name : *Oong nga nangisit*
Edibility : edible
Substrate : living trunk of acacia
Location : Daya

Pleurotaceae
***Pleurotus cystidiosus* O.K. Mill (1969)**
Description : Large light gray to brownish fan-shaped pileus with longer eccentric stipe. (Figure 3I)
Local Name : *Oong bay-yabas*
Edibility : edible
Substrate : decaying part of the living guava tree
Location : Laod
***Pleurotus djamor* (Rumph. ex Fr.) Boedijn (1959)**
Description : Small size white shallowly funnel-shaped pileus attached laterally to short stipe. (Figure 3J)
Local Name : None
Edibility : edible
Substrate : fallen trunk of mango tree
Location : Daya
***Pleurotus* sp.**
Description : Medium size white funnel-shaped pileus with very short stipe. (Figure 3K)
Local Name : *Oong puraw*
Edibility : edible
Substrate : fallen trunk of ipil-ipil tree
Location : Amianan
Polyporaceae
***Coriolus versicolor* (L.) Quel. (1886)**
Description : Small to medium size, thin, leathery, bluish brown to light yellowish brown, overlapping bracket fungus. (Figure 3L)
Local Name : *Oong kayu*
Edibility : edible
Substrate : rotten woods of madre de cacao
Location : Bagatan
***Fomitopsis* sp.**
Description : Large size, thick woody bracket with mostly brown to gray upper surface. (Figure 3M)
Local Name : *Oong kayu*
Edibility : inedible
Substrate : rotten trunk of guava tree
Location : Daya
***Lentinus tigrinus* (Bull.) Fr. (1825)**
Description : Medium size gray to brownish fruiting body with shallow funnel-shaped pileus with dark brown scales. The stipe is centric or eccentric with fibrillose surface (Figure 3N)
Local Name : *Oong tigre*
Edibility : edible
Substrate : rotten woods of acacia
Location : Laod
***Polyporus grammocephalus* Berk. (1842)**

Description : Medium size, thick, brown to gray fan-shaped pileus attached to eccentric stipe. The underside has large angular pores. (Figure 3O)
Local Name : *Oong kayu*
Edibility : edible
Substrate : bark of acacia tree
Location : Bagatan
Schizophyllaceae
***Schizophyllum commune* Fries (1815)**
Description : Small size light gray to light brown, tough, hairy fan-shaped pileus with split-edged gills. (Figure 3P)
Local Name : *kudit*
Edibility : edible
Substrate : bark of tamarind tree
Location : Bagatan
Stereaceae
***Stereum hirsitum* (Willd.) Pers. (1800)**
Description : Medium size thin bracket laterally attached to wood. The upperside has multicoloured zone while the underside has minute pores. (Figure 3Q)
Local Name : *Oong kayu*
Edibility : not recommended
Substrate : rotten log
Location : Laod
Tremellaceae
***Tremella foliacea* Pers. (1800)**
Description : Dense clusters of gelatinous brown, thin, leaf-like shaped fruiting bodies (Figure 3R)
Local Name : None
Edibility : edible but not much valued
Substrate : dead truck of ipil-ipil tree
Location : Amianan
***Tremella mesenterica* Retz (1769)**
Description : The fruiting body has gelatinous yellowish brown with irregular shaped (Figure 3S)
Local Name : None
Edibility : edible but not much valued
Substrate : living branch of mango tree
Location : Amianan

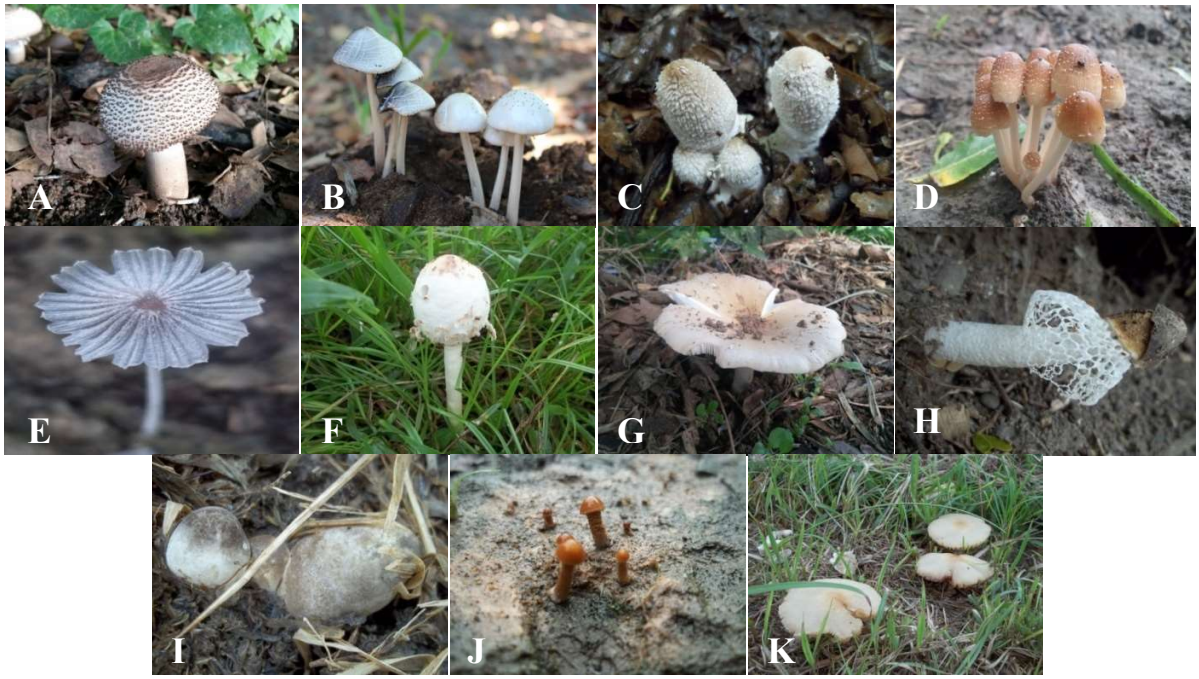

Figure 2: Naturally occurring leaf litter-, soil-, and dung-decomposing mushrooms in Brgy. Bambanaba, Cuyapo, Nueva Ecija. (A) *Amanita onusta*, (B) *Panaeolus semiovatus*, (C) *Coprinus comatus*, (D) *Coprinellus micaceus*, (E) *Coprinus plicatilis*, (F) *Chlorophyllum molybdites*, (G) *Termitomyces clypeatus*, (H) *Dictyophora indusiata*, (I) *Volvariella volvacea*, (J) *Psilocybe coprophila*, and (K) *Marasmius oreades*.

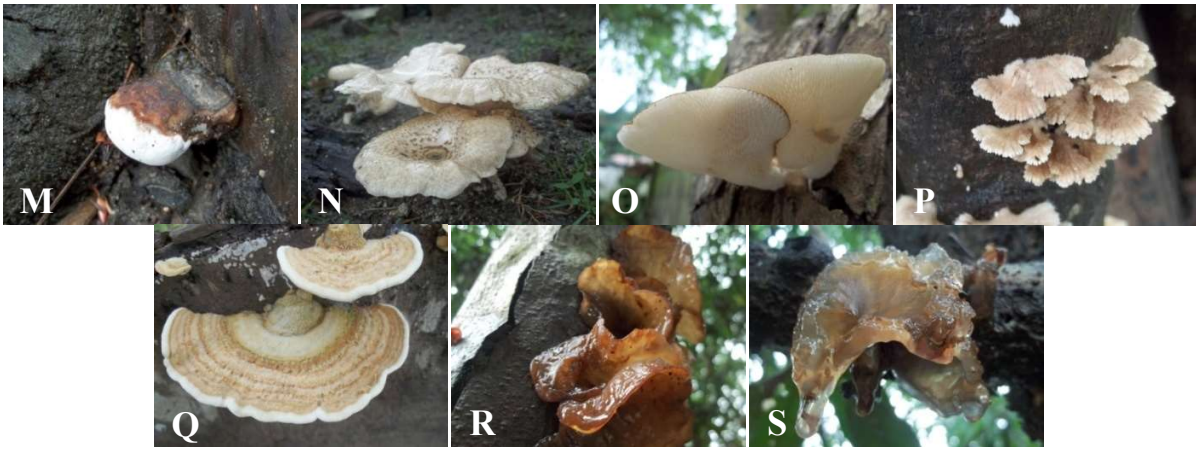

Figure 3: Naturally occurring wood-rotting mushrooms in Brgy. Bambanaba, Cuyapo, Nueva Ecija. (A) *Auricularia auricular-judae*, (B) *Auricularia polytricha*, (C) *Dacryopinax spathularia*, (D) *Ganoderma lucidum*, (E) *Ganoderma neo-japonicum*, (F) *Ganoderma sinense*, (G) *Ganoderma* sp., (H) *Phellinus linteus*, (I) *Pleurotus cystidiosus*, (J) *Pleurotus djamor*, (K) *Pleurotus* sp., (L) *Coriolus versicolor*, (M) *Fomitopsis* sp., (N) *Lentinus tigrinus*, (O) *Polyporus grammocephalus*, (P) *Schizophyllum commune*, (Q) *Stereum hirsitum*, (R) *Tremella foliacea*, and (S) *Tremella mesenterica*.

Aside from being edible, many of the identified mushrooms are also medicinal such as *G. lucidum, C. versicolor, S. commune, P. linteus, V. volvacea, P. grammocephalus, T. clypeatus, C. comatus, L. tigrinus, D. indusiata*, *A. polytricha* and *P. djamor*. These mushrooms could be significant source of bioactive compounds with various functional activities. One of the most important medicinal mushrooms is *G. lucidum*. It is used treat chronic hepatitis, hypertension, arthritis, insomnia, bronchitis, asthma, gastric ulcer, diabetes and cancer. It possesses anti-tumor activity and has also been found to inhibit platelet aggregation and to lower blood pressure, cholesterol and blood sugar **[9]**. *P. linteus* extract exhibits antitumor activity by inducing growth arrest and apoptosis in human lung and prostate cancer cells **[10]**. *V. volvacea* is known for its radical scavenging and antimicrobial potential and contains substances with cardiovascular, immunomodulatory and antitumor activity **[11, 12, 13]**. *L. tigrinus* and *P. djamor* possess antibacterial and antioxidant activities **[14]**. Moreover, extracts of *Auricularia, Flammulina, Ganoderma, Grifola, Lentinus, Pleurotus, Coriolus, Schizophyllum, Tremella,* and *Phellinus* have demonstrated medicinal properties and these species have been traditionally used for long time **[15, 16]**. Jikai **[17]** identified 30 species of medicinal mushrooms which can be sources of biologically active metabolites with promising potential as anticancer.

CONCLUSION

Collectively, the agro-ecosystem of Brgy. Bambanaba, Cuyapo, Nueva Ecija is a natural habitat of several mushrooms with great potential for cultivation and could demonstrate different biological activities. There are, however, parts in the Philippines that still have not been explored, thus, there is a need to study the diversity of wild mycological resources that can be used for various purposes.

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