Vol. 4 January 2013
CHED Accredited Research Journal, Category A
Print ISSN 2094-5019 • Electronic ISSN 2244-0461
doi: http://dx.doi.org/10.7828/ajob.v4i1.297

Asian Journal of Biodiversity
Art. #297 pp. 65-83
This Journal is in the Science Master Journal List of
Thomson Reuters (ISI) Zoological Record

Occurrence and Diversity of Myxomycetes (Plasmodial Slime Molds) along the Northern Slope of Mt. Makulot, Cuenca, Batangas, Philippines

CHRISTIAN BERNARD T. CHENG
ORCID NO. 0000-0001-6518-2739
Alnardra@yahoo.com.ph
KATE NICOLE T. YU
ORCID NO. 0000-0002-6840-5798
katenicoleyu@yahoo.com
MONICA L. CAMPOS
ORCID NO. 0000-0002-1639-6244
monica_2719@yahoo.com
JAIRA MICHELLE V. ADORA
ORCID NO. 0000-0003-1560-8097
jvadora.sbcm@gmail.com
GERALD CEASAR P. PASCUA
ORCID NO. 0000-0003-2196-2439
fifo.prijoles@yahoo.com
MARIA VICTORIA B. PANGILINAN
ORCID NO. 0000-0002-8466-1935
vixpangie@yahoo.com
ANTHONY T. BUAYA
ORCID NO. 0000-0002-0031-0012
anthonybuaya@gmail.com
THOMAS EDISON E. DELA CRUZ
ORCID NO. 0000-0002-5505-3498
tedelacruz@mnl.ust.edu.ph
University of Santo Tomas,
España 1015 Manila, Philippines

Abstract - Lowland forests in the Philippines are ideal study sites for myxomycetes due to its cool climate and rich vegetation. Thus, our research study aims to determine the myxomycete assemblages present in Mt. Makulot, Cuenca, Batangas. Aerial and ground leaf litter and twigs were collected and placed in moist chambers for 8 weeks under diffused light. Myxomycetes from the moist chambers and field collections were identified based on sporocarp and spore morphologies. A total of 21 species from 10 genera were collected from Mt. Makulot, with a high number of myxomycetes, *i.e*. 10-11 species, collected from aerial leaf litter and twigs. Only six species were obtained from ground leaf litter. Species diversity was also observed to be high on twigs. The myxomycetes collected were identified as *Arcyria afroalpina*, *A. cinerea*, *A. denudata, Collaria sp., Diachea bulbilosa*, *D. splendens*, *Diderma effusum*, *D. hemisphaericum*, *Didymium nigripes*, *D. squamulosum*, *Hemitrichia calyculata*, *Lycogala sp., Perichaena chrysosperma*, *P. pedata, Physarum compressum*, *P. globuliferum*, *P. melleum*, *Physarum sp., Stemonitis sp., S. fusca*, and *S. herbatica*. Among the collected species, *A. cinerea* was recorded to be the most abundant. Ten species were noted as rare. This is the first report of myxomycetes in Mt. Makulot, Cuenca, Batangas.

Keywords - lowland forests, myxomycetes, species abundance, species distribution, species diversity

INTRODUCTION

Myxomycetes (plasmodial slime molds) are fungus-like, phagotrophic, eukaryotic organisms commonly occurring in terrestrial forests habitats. Their life cycle includes a single-celled myxamoeba derived from a single spore. This myxamoeba replicates by fission and later may fuse and develop into a plasmodium. The plasmodium moves and feeds by phagocytosis or ingestion, and under unfavorable conditions, will develop further into sporocarps or fruiting bodies with spores. Temperature, pH, moisture, substrate, and available food source (e.g., bacteria, yeast, and other protists) were reported to have a profound influence on their life cycle and microhabitat distribution (Everhart and Keller 2008; Stephenson 1989). But distribution of myxomycetes is observed throughout the year in all substrate types (Stephenson 1989; Stephenson 1988). In the

Philippines, limited studies have been conducted on the biodiversity and ecology of myxomycetes. Uyenco (1973) listed 18 species while Dogma (1975) credited the country with 46 species. Reynolds (1981) reported 107 species of myxomycetes from different provinces in the Philippines and recorded 53 new records at that time. Presently, a number of studies have been conducted on different localities in the Philippines reporting new records of myxomycetes (Dagamac et al., 2010; Dagamac et al., 2011; Macabago et al., 2010, 2012). Dagamac et al. (2010) reported seven species of corticolous myxomycetes with five new records for the country. Thirty three species of myxomycetes were also recorded from Mt. Arayat National Park in Pampanga in which 5 species were new records for the country (Dagamac et al. 2011). Similarly, Macabago et al. (2010) recorded 28 species of 10 genera from 240 moist chambers from La Mesa Ecopark, Quezon City. In Lubang Island, Occidental Mindoro, 45 taxa and six new records were reported (Macabago et al., 2012). However, these reported studies on myxomycetes in the Philippines were relatively few compared to other studies done in other Southeast Asian countries. The vegetation type of Mt. Makulot was previously studied by Arseño et al. (2011) and was found to have intact forest vegetation with high plant diversity. This makes Mt. Makulot an ideal site to study myxomycete diversity. This paper is the first biodiversity study of myxomycetes within the forested areas of Mt. Makulot, Batangas.

OBJECTIVES OF THE STUDY

This research study aims to assess the occurrence and diversity of myxomycetes within the forested area of Mt. Makulot in Cuenca, Batangas, Philippines.

MATERIALS AND METHODS

Study site. Mt. Makulot (13°55′15″N; 121°2′30″E), located in Cuenca, Batangas, is a 600-meter high volcanic rock wall part of the Taal volcano's crater rim (Fig. 1). The slopes of Taal volcano form ridges surrounding the Taal Lake and Mt. Makulot is the highest volcanic cone on the south side. At 600 meter above sea level (masl), the mountain has a generally cool climate with temperatures ranging from

23˚C – 31˚C. Annually, it receives a rainfall of 398.2 mm and a relative humidity reaching 87%. These climatological data were obtained from the Philippine Atmospheric, Geophysical, and Astronomical Service Administration (PAGASA). Dominant plant species in Mt. Makulot include *Canarium asperum* Benth (Burseraceae), *Diplodiscus paniculatus* Turcz. (Malvaceae), *Bischoffia javanica* Bl. (Phyllanthaceae), and *Palaquium philippinense* (Perr.) C.B. Rob. (Sapotaceae) (Arseño et al., 2011).

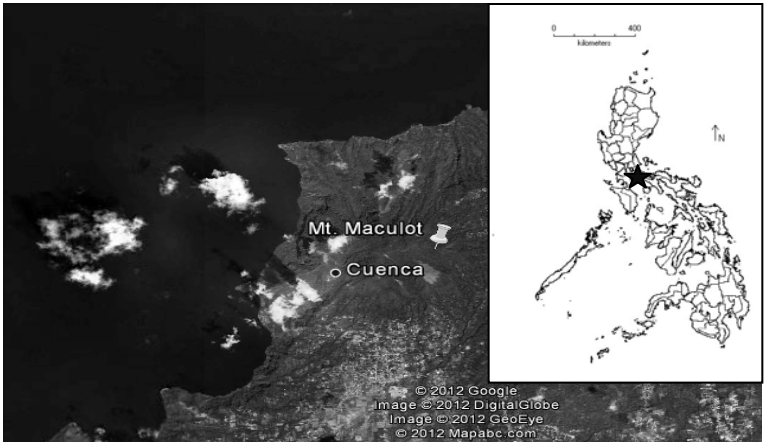

Fig. 1. The Study Site: Mt. Makulot, Cuenca Batangas, Philippines (Map Source: GoogleEarth)

Collection of substrates and preparation of moist chamber set-ups and herbaria. Field specimens of myxomycetes were collected directly from decaying logs along the trail to the northern peak of Mt. Makulot. Different substrates (*i.e.*, aerial leaf litter, ground leaf litter, and twigs) were also collected along the trail. Twenty samples of each of aerial leaf litter (AL), ground leaf litter (GL), and twigs (TW) were collected on July 2010. These substrates were placed immediately in brown paper bags and air-dried on open space for at least one week prior to the preparation of moist chambers following the protocol of Stephenson and Stempen (1994). A total of 180 moist chamber (MC) cultures were prepared for the three collected samples (aerial and ground leaf litter, and twigs). Three moist chambers were set-up for each of the collected specimens. The moist chambers were incubated at room temperature for up to two months and regularly checked every

week for myxomycetes. All sporocarps of myxomycetes collected from the field and moist chambers were then placed in herbarium boxes and labelled properly. All voucher specimens were deposited at the Pure and Applied Microbiology Laboratory, Research Center for the Natural and Applied Sciences, University of Santo Tomas, Manila, Philippines.

Characterization and identification of myxomycetes. Morphological descriptions of sporocarps were observed under a dissecting microscope. Characters recorded were type, shape, color of sporocarps, and other morphological characters. Spore morphology was also studied following preparation of specimen slides of each of the collected species of myxomycetes. Slides were prepared initially by mounting sporocarps on glass slides with 95% ethanol as mounting medium, and then, 15% potassium hydroxide (KOH) was also added before the cover slip was placed. Spore descriptions, e.g. spore color, size, shape, texture, ornamentation, and other characters, were noted under a compound light microscope (Nikon E 100 Educational Basic Binocular). Identification was done following comparison of sporocarp and spore morphologies with published literatures, e.g. Stephenson and Stempen (1994), Keller and Braun (1999), online database (http://slimemold.uark.edu/), and web-based identification key, e.g. SYNKey (Mitchell, 2008).

Diversity assessment

Percent yield. The percentage yield for each of the collected substrates was determined. Here, the number of moist chambers positive for either a plasmodium or a fruiting body (sporocarp) was counted, and then, divided by the total number of moist chambers prepared (Macabago et al., 2010).

Species Abundance. The relative abundance of each species of myxomycetes was also computed by the number of MC positive for a myxomycete species divided by the total number of MC positive for myxomycetes. Here, a moist chamber positive with sporocarps of a specific myxomycete species is considered as one positive collection. Abundant indices were then assigned to all the representative species:

rare (R) for species less than 3% of the total number of collections, occasional (O) for species more than 3% but less than 5% of the total number of collections, common (C) for species more than 5% but less than 10% of the total number of collections, and abundant (A) for species more than 10% of the total number of collections (Stephenson et al., 1993).

Taxonomic and Species Diversity. The taxonomic diversity refers to the ratio of the species to the genera of myxomycetes for each of the collected substrates. To assess the taxonomic diversity, the number of species and its corresponding genera were initially determined and the S/G ratio was then calculated by dividing the number of species by the number of genera for each of the collected substrata. Note that the value for the S/G ratio is inversely proportional to its taxonomic diversity. Species diversity, richness and evenness were also computed based on the relative abundance of the collected myxomycetes. Species diversity using the Shannon-Wiener Index, species richness using the Gleason index, and evenness using the Pielou Index of Evenness for each of the collected substrates were computed as described in Dagamac et al. (2012). A modified t-test (VarH) was used to test if there is any significant difference among the diversity indices of the collected substrates (Magurran, 2004).

Community analysis. Initially, the numbers of species were determined for the each of the substrate including the number of species common to both substrates. Coefficient of Community is the percentage of species that the two communities have in common. It was calculated to compare the similarity of the two plots in terms of the species present. The Jaccard's similarity coefficient is a statistic tool used for comparing the similarity and diversity of sample sets. In this study, the Coefficient of Community and the Jaccard's similarity values were calculated as described by Dagamac et al. (2012).

RESULTS

Percent yield. Of the 180 total moist chambers prepared from substrates collected in Mt. Makulot, 152 or 84% showed the presence of myxomycetes either as plasmodia or sporocarps. Sporocarps were recorded in 132 MC while plasmodia were noted only in 78 MC. Aerial

leaf litter had the most number of myxomycetes recorded (90% of all MC) followed by ground leaf litter and twigs (both at 82%). Aerial leaf litter also had higher plasmodia and fruiting body yield with 50% and 83%, respectively. Ground leaf litter had 42% and 68%, and twigs had 38% and 68% for plasmodia and sporocarps, respectively.

Species list. A total of 68 specimens of myxomycetes were collected directly in the field and were identified as 13 species belonging to 8 genera (Fig. 2). Among the collected field specimens, *Physarum globuliferum* had the highest number of collections followed by *Arcyria denudata* and *Didymium nigripes*. Two to three collections were recorded for *Arcyria cinerea, Collaria sp., Didymium squamulosum, Hemitrichia calyculata, Lycogala sp., Perichaena chrysosperma, Physarum compressum, Physarum melleum, Stemonitis fusca,* and *Stemonitis sp.*. From the 132 moist chambers recorded with sporocarps, 17 species belonging to 8 genera were identified (Fig. 2). Among the myxomycetes collected from the moist chambers, *Physarum* has the most number of species, namely, *P. compressum*, *P. globuliferum*, *P. melleum,* and *Physarum sp.* Two species of *Arcyria* (*A. afroalpina* and *A. cinerea*), *Diachea* (*D. bulbilosa* and *D. splendens*), *Diderma* (*D. effusum* and *D. hemisphaericum*), *Didymium* (*D. nigripes* and *D. squamulosum*), *Perichaena* (*P. chrysosperma* and *P. pedata*), and *Stemonitis* (*S. fusca* and *S. herbatica*) were also recorded. One species of *Lycogala* was also noted in the study. More species of myxomycetes were recorded in moist chambers than from specimens collected in the field.

We further compare the species assemblages between the field specimens and moist chamber cultures. Our result showed that *A. cinerea, D. nigripes, D. squamulosum, Lycogala sp., P. chrysosperma, P. compressum, P. globuliferum, P. melleum,* and *S. fusca* were common in both moist chamber and field collections. *A. denudata, Collaria sp., H. calyculata,* and *Stemonitis sp.* were only recorded from field collections while *A. afroalpina, D. bulbilosa, D. splendens, D. effusum, D. hemisphaericum, P. pedata, Physarum sp.*, and *S. herbatica* were only recorded in moist chambers. In relation to the substrate type, *A. cinerea, D. nigripes,* and *P. globuliferum* were recorded in all of the three substrates (AL, GL, & TW). *D. effusum, D. hemisphaericum, Lycogala sp.*, and *P. melleum* were recorded only in aerial leaf litter, while *P. chrysosperma, P. pedata, P. compressum, S. fusca,* and *S. herbatica* were only recorded from twigs.

D. bulbilosa was the recorded only in ground leaf litter. In AL and GL, *D. splendens* and *D. squamulosum* were recorded while *A. afroalpina* and *Physarum sp.* were found in AL and TW.

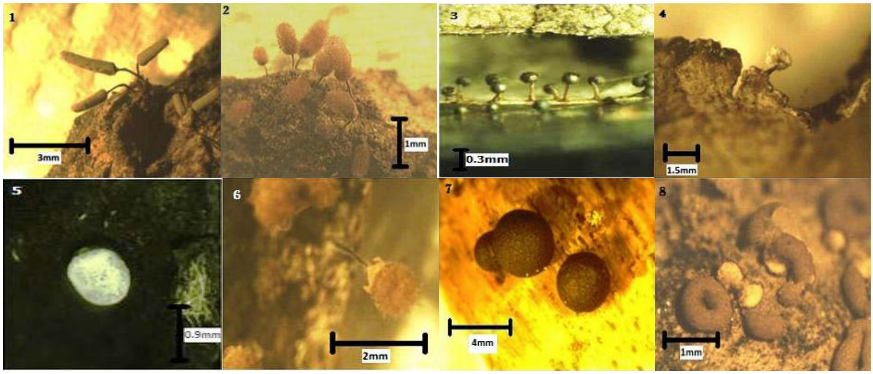

Fig. 2. Representative species of myxomycetes recorded in Mt. Makulot, Cuenca, Batangas: (1) *Arcyria cinerea*, (2) *Arcyria denudata*, (3) *Diachea bulbilosa*, (4) *Didymium squamulosum*, (5) *Diderma hemisphaericum*, (6) *Hemitrichia calyculata*, (7) *Lycogala sp.*, and (8) *Perichaena chrysosperma*.

Species Abundance. The relative abundance for each of the collected species of myxomycetes from the moist chamber was determined (Table 1). *Arcyria cinerea* was recorded as the most abundant species in Mt. Makulot. *A. cinerea* was followed in terms of abundance by *A. afroalpina* and *D. squamulosum*. *D. nigripes* and *P. globuliferum* were recorded as commonly occurring while *D. splendens* and *D. hemisphaericum* were recorded as occasionally occurring. Ten species were recorded as rare. Among the myxomycetes recorded from ground leaf litter, *A. cinerea* and *D. squamulosum* were recorded as abundant while *D. bulbilosa*, *D. splendens*, and *D. nigripes* were recorded as commonly occurring. In aerial leaf litter substrates, *A. afroalpina*, *A. cinerea*, and *D. squamulosum* occurred abundantly. *D. splendens*, *D. hemisphaericum*, and *D. nigripes* were recorded as commonly occurring and *D. effusum*, *Lycogala sp.*, *P. globuliferum*, *P. melleum*, and *Physarum sp.* were recorded as rare. Lastly, in twigs, *A. afroalpina*, *A. cinerea*, and *P. globuliferum* were abundant while *D. nigripes*, *P. chrysosperma*, *P. pedata*, *P. compressum*, *Physarum sp.*, *S. fusca*, and *S. herbatica* were commonly occurring.

Table 1. Relative abundance of myxomycetes in relation to their substrates: aerial leaf litter (AL), ground leaf litter (GL), and twigs (TW).

Taxon	GL	AL	TW
Arcyria afroalpina Rammeloo	-	A	A
Arcyria cinerea (Bull.) Pers.	A	A	A
Diachea bulbilosa (Berk. & Br.) A. Lister	C	-	-
Diachea splendens Peck.	C	C	-
Diderma effusum (Schwein) Morgan	-	R	-
Diderma hemisphaericum (Bull) Hornem	-	C	-
Didymium nigripes (Link) Fr	C	C	C
Didymium squamulosum (Alb et Schwein) Fr	A	A	-
Lycogala sp.	-	R	-
Perichaena chrysosperma (Curr) Lister	-	-	C
Perichaena pedata (Lister et G. Lister) Lister ex E. Jahn	-	-	C
Physarum compressum Alb, et Schwein	-	-	C
Physarum globuliferum (Bull) Pers	C	R	A
Physarum melleum (Berk et Broome) Massee	-	R	-
Physarum sp.	-	R	C
Stemonitis fusca Roth	-	-	C
Stemonitis herbatica Peck	-	-	C

[a] Relative abundance = $\frac{Number\ of\ Collections}{Total\ Number\ of\ Collections} \frac{Number\ of\ Collections}{Total\ Number\ of\ Collections}$

[b] Abundance indices:

Abundant (A) if relative abundance is ≥10% of the total collections,
Common (C) if relative abundance is ≥5% but <10% of the total collections,
Occasionally occurring (O) if relative abundance is ≥3% but <5% of the total collections, and
Rare (R) if relative abundance is <3% of the total collections.

Taxonomic and Species Diversity. In our study, a total of 17 species belonging to 8 genera were noted from moist chambers. Aerial leaf litter had 11 species belonging to 6 genera. Twigs had 10 species and 5 genera, while ground leaf litter had 6 species and 4 genera. However, twigs had the highest S/G ratio (S/G=2.00) followed by aerial leaf litter (S/G=1.83). Ground leaf litter had the lowest S/G ratio (S/G = 1.50) and thus, was more taxonomically diverse than aerial leaf litter and twigs (Table 2).

Table 2. Number of Species and Genera of Myxomycetes collected at different substrates

Substrate	No. of Species	No. of Genus	S/G	H_S	H_G	E
AL	11	6	1.83	2.01	2.84	0.54
GL	6	4	1.50	1.45	1.85	0.57
TW	10	5	2.00	2.06	3.06	0.70

To further assess the diversity, the Shannon, Gleason and Pielou's Indices were computed based on the relative abundance of myxomycetes (Table 2). Higher species diversity was recorded in twigs (H_S=2.06) followed by aerial (H_S=2.01) and ground (H_S=1.45) leaf litter. Species richness using the Gleason index showed that twigs (H_G=3.06) were also species richer than aerial (H_G=2.84) and ground (H_G=1.85) leaf litter. Twigs (E=0.70) had higher evenness compared to ground (E=0.54) and aerial (E=0.57) leaf litter. T-test analysis further showed significant differences between the diversity values for each substrate type.

Community Analysis. The similarities in myxomycete assemblages between the substrates collected were analyzed using the Coefficient of Community (CC) and Jaccard's Similarity Values (Table 3). Ground and aerial leaf litter had higher CC (0.59) and JS (0.42) values indicating that a high number of similar myxomycetes was recorded between the two substrata. Twigs and aerial leaf litter have a CC value of 0.48 and a JS value of 0.31. Ground leaf litter and twigs substrates have a CC

value of 0.38 and a JS value of 0.23. Of the collected myxomycetes, *A. cinerea, D. nigripes*, and *P. globuliferum* appeared in all substrates. *D. splendens* and *D. squamulosum* were recorded in ground and aerial leaf litter while *A. afroalpina* and *Physarum sp.* were recorded in both aerial leaf litter and twigs. *D. effusum, D. hemisphaericum, Lycogala sp.*, and *P. melleum* appeared in aerial leaf litter only. *D. bulbilosa* was recorded only in ground leaf litter while *P. chrysosperma, P. pedata, P. compressum, S. fusca*, and *S. herbatica* were found only in twigs.

Table 3. Sorensen's Coefficient of Community (lower left) and Jaccard's Similarity Coefficient (upper right) values of ground leaf litter (GL), aerial leaf litter (AL), and twigs (TW) based on the presence or absence of myxomycetes.

	GL	**AL**	**TW**
GL	X	0.42	0.23
AL	0.59	X	0.31
TW	0.38	0.48	X

DISCUSSION

The present study reports the occurrence and diversity of myxomycetes in Mt. Makulot in Cuenca, Batangas. Though the study site is not classified as a protected area or a national park, the presence of an intact forest with rich biodiversity merits a thorough study of the site. In fact, biodiversity assessment of macrofungi and plants in Mt. Makulot reported 34 families of macrofungi from 16 genera (Tadiosa et al., 2007) and 61 tree species from 51 genera (Arsenio et al., 2010). However, none was so far recorded for myxomycetes in the locality of Mt. Makulot. In this study, 17 species identified from 8 genera were recorded from moist chamber cultures of aerial and ground leaf litter, and twigs. Only 13 species belonging to 8 genera were recorded from field collection. A high number of species of myxomycetes was therefore noted in moist chambers than from the field collections. This is expected since moist chambers mimic the ideal environmental

conditions for the growth and development of myxomycetes. Also, in the field, many small species of myxomycetes could not readily be observed and collected. In contrast, in the study of Stephenson et al. (2004), less collection was noted from moist chambers (443) than field (564) collections. This could be attributed to the extensive collection done in the field during sampling. In Macabago et al. (2012), 35 collections were noted from the field while 683 collections were obtained from moist chambers as is the case here.

In the study, a high percentage of the MC (84%) yielded myxomycetes. Many of these had sporocarps (73%). Studies on myxomycetes in the tropics and temperate regions utilized moist chambers, and were found adequate to assess myxomycetes diversity (Schnittler et al., 2002; Lado et al., 2003; Stephenson et al., 2004; Snell and Keller, 2003). In relation to substrates, aerial leaf litter had the highest yield as compared to ground leaf litter and twigs. This difference can be attributed to the physical characteristics of the substrates, in which the rough surface of aerial leaf litter favors trapping of spores being dispersed from the air before reaching the ground surface (Stephenson, 1989). Macabago et al. (2010), Dagamac et al. (2012), and Kilgore et al. (2009) all reported more moist chambers with myxomycetes from aerial leaf litter. However, analysis of the S/G ratio between the three substrates showed that ground leaf litter had the lowest S/G ratio (1.50) and thus, was more taxonomically diverse than aerial leaf litter and twigs. Aerial leaf litter had 11 species, 6 genera, followed by twigs with 11 species, 5 genera, and ground leaf litter with 6 species, 4 genera (Table 2). Though more species were recorded in aerial leaf litter and twigs than ground leaf litter, GL remained more taxonomically diverse, since as stated by Stephenson et al. (1993), a biota in which the species are divided among many genera is "intuitively" more diverse in a taxonomic sense than one in which most species belong to only a few genera. Also, several species of myxomycetes tend to manifest substrates specificity in relation to woody materials or ground litter (Stephenson et al., 2004). Study conducted in the tropics by Schnittler et al. (2000) noted higher productivity of litter samples in moist chambers, as compared to woody substrates. However, Snell and Keller (2003) noted high species diversity in woody substrates in Great Smoky Mountain Park. Between the two studies, it can be demonstrated that

difference in microhabitat temperature tend to have a great influence on myxomycetes occurrence and distribution since studies conducted by Schnittler et al. (2000) was conducted in tropics, while Snell and Keller (2003) was in temperate forest.

The relative abundance for each of the collected species of myxomycetes from the moist chamber was also determined. *A. cinerea* was the most abundant among species of myxomycetes recorded from moist chambers from three substrates from Mt. Makulot (Table 1). The abundance of *A. cinerea* and other *Arcyria* species as well as *Physarum* species could be attributed to its being a cosmopolitan species, e.g. the species were recorded in Ecuador, Germany, United States, and Thailand (Schnittler et al., 2002; Schnittler et al., 2006; Snell & Keller 2003; Tran et al., 2008), including the Philippines (Dagamac et al., 2012; Macabago et al., 2012). Their cosmopolitan distribution could be a result of their better spore dispersal and adaptation to growth (Schnittler et al., 2002; Lado et al., 2003). Species belonging to genus *Diderma* and *Lycogala*, and some species of *Physarum* were also previously reported as rare in other studies (Tran et al., 2008; Tran et al., 2006; Macabago et al., 2010) as also reported in this study. These studies noted that seasonality, substrates type, and temperature were important factors for the distribution of these three species.

In this study, relative abundance was used to determine species diversity. Higher diversity was recorded in twigs (H_S= 2.06, H_G= 3.06) and aerial leaf litter (H_S= 2.01, H_G= 2.84) as compared to the ground leaf litter (H_S=1.45, H_G= 1.85). In taxonomic diversity, a higher value was recorded in GL in spite of its low number of species because the number of species is correlated with a high number of genera. In species diversity, TW and AL had more species recorded and many of these species are abundant or commonly occurring. This means that if the abundance was correlated with the number of species present, a different pattern may be observed. In terms of species evenness, twigs remained the highest (E= 0.70). But statistical analysis showed no significant differences between the species diversities from each of the collected substrates. Several factors, such as pH, temperature, available food (e.g., bacteria, other protists, and yeasts) and moisture availability affects spores germination and in some instances, favors only certain myxomycetes species (Keller & Snell, 2002; Clark et al.,

2003; Rojas et al., 2007; Schnittler et al., 2006). For example, species belonging to order *Stemonitales* and *Liceales* prefer acidic substrates (Kilgore et al., 2009). Species of *Arcyria, Clastoderma*, and *Echinostelium* generally occur in acidic environment while species belonging to genus *Physarum*, *Trichia,* and *Didymium* prefer alkaline substrates (Mosquera et al., 2003; Wrigley de Basanta et al., 2008). These factors could also have contributed to the myxomycete diversity observed in the study.

In term of similarities of myxomycetes assemblages between the substrate types, Coefficient of Community (CC) and Jaccard's Similarity (JS) values showed that aerial and ground leaf litter had higher CC (0.59) and JS (0.42) values (Table 3), indicating a high similarity between the myxomycetes recorded in the two substrates. Aerial and ground leaf litter being same in chemical component may have similarities in decay, and thus, have more bacteria as food (Stephenson 1988).Thus, leaf litter serve to be a favorable microhabitat for myxomycetes. This was also demonstrated by studies conducted by Schnittler et al., (2002) and Lado et al., (2003) in the tropical forest of Ecuador and Mexico. In the study, *D. effusum, D. hemisphaericum, Lycogala sp.*, and *P. melleum* appeared only in aerial leaf litter. *D. bulbilosa* was recorded only in ground leaf litter while *P. chrysosperma, P. pedata, P. compressum, S. fusca*, and *S. herbatica* were found only in twigs. Various species of myxomycetes only occur on certain types of microhabitat while other does not occur on other types as is the case in this study.

CONCLUSIONS

Twenty one species of myxomycetes belonging to 10 genera were recorded in substrates collected along the northern forest trail of Mt. Makulot, Cuenca, Batangas. The species identified based on their sporocarp and spore morphologies were *A. afroalpina*, *A. cinerea*, *A. denudata*, *Collaria sp.*, *D. bulbilosa, D. splendens, D. effusum, D. hemisphaericum*, *D. nigripes*, *D. squamulosum*, *H. calyculata*, *Lycogala sp.*, *P. chrysosperma*, *P. pedata*, *P. compressum*, *P. globuliferum*, *P. melleum*, *Physarum sp.*, *Stemonitis sp.*, *S. fusca*, and *S. herbatica*. Assessment of myxomycete occurrence per substrates showed *A. cinerea*, *D. nigripes*, and *P. globuliferum* as present in all substrates. Four species were found only on aerial leaf litter while five species were observed only on twigs.

D. bulbilosa recorded only on ground leaf litter. *A. cinerea* was recorded to be the most abundant of all the collected myxomycetes followed by *A. afroalpina* and *D. squamulosum*. Higher taxonomic diversity was noted from ground leaf litter while species diversity was high on twigs. Comparison of myxomycete communities also showed higher species similarity between aerial and ground leaf litter. This is the first report of plasmodial myxomycetes in Mt. Makulot, Cuenca, Batangas.

ACKNOWLEDGMENTS

The authors would like to thank the Research Center for the Natural and Applied Sciences of the University of Santo Tomas Manila under the directorship of Christina Binag, Ph. D. for the laboratory, research facility, and research grant used in this study.

LITERATURE CITED

Arsenio J., M. Medecilo, E. Mercado, E. Jr. Salibay and F. A. Valera
2011 Vegetation Analysis of Mt. Maculot, Cuenca, Batangas, Philippines. *International Conference on Environment and Industrial Innovation* 12: 252-256.

Clark, J.
2003 Plasmodial incompatibility in the myxomycete Didymium squamulosum. *Mycologia* 95: 24-26.

Dagamac, N. H. A., dela Cruz, T. E. E., Pangilinan, M. V. B. and S. L. Stephenson
2011 List of species collected and interactive database of myxomycetes (plasmodial slime molds) for Mt. Arayat National Park, Pampanga, Philippines. *Mycosphere* 2: 449–455.

Dagamac, N. H. A., Leontyev, D.V. and T. E. E. dela Cruz
2010 Corticolous Myxomycetes associated with *Samanea samans* (Jacq.) Merr. collected from different sites in Luzon Island, Philippines. *The Philippine Biota* 43: 2–15.

Dagamac, N. H. A., Stephenson, S. L, & T. E. E. dela Cruz
2012 Occurrence, distribution and diversity of myxomycetes (plasmodial slime molds) along two transects in Mt. Arayat National Park, Pampanga, Philippines. *Mycology* 3: 119–126.

Dogma, I.J.
1975 Of Philippine mycology and lower fungi. *Philipp. J. Biol.,* 4: 69-105.

Everhart., S. E., Keller., H. W. and J. S. Ely
2008 Influence of bark pH on the occurrence and distribution of tree canopy myxomycetes species. *Mycologia* 100: 191-204.

Kilgore, C. M., Keller, W. H. and J. S. Ely
2009 Aerial reproductive structures of vascular plants as a microhabitat for myxomycetes. *Mycologia* 101: 305-319.

Lado, C., Estrada-Torres, A., Beltran-Tejera, E. and D. Wrigley de Basanta
2007 Description and culture of a new succulenticolous Didymium (Myxomycetes). *Mycologia* 99: 602-6011.

Lado, C., Estrada-Torres, A., Stephenson, S. L., Wrigley de Bessanta, D, & M. Schnittler
2003 Biodiversity assessment of myxomycetes from tropical forest reserves in Mexico. *Fungal Diversity* 12: 67-110.

Macabago, S. A. B., Dagamac, N. H. A. and T. E. E. dela Cruz
2010 Diversity and distribution of plasmodial myxomycetes (slime molds) from La Mesa Ecopark, Quezon City, Philippines. *Biotropia*, 17: 51–61.

Macabago, S. A. B., dela Cruz, T. E. E, and Stephenson, S. L.
2012 First records of myxomycetes from Lubang Island, Occidental Mindoro, Philippines. *Sydowia* 64 (1): 109-118.

Magurran, A.E.
2004 Measuring biological diversity. Oxford, Blackwell publishing.

Mosquera, J., Lado, C., Estrada-Torres, A. and D. Wrigley de Basant
2003 Description and culture of a new myxomycete, Licea succulenticola. *Anal Jard Bot Madrid* 60: 3-10.

Reynolds, D.R.
1981 Southeast Asian myxomycetes II. Philippines. *Philipp. J. Biol.* 10: 127-150.

Rojas, C. and S. L. Stephenson
2007 Distribution and ecology of myxomycetes in the high-elevation oak forest of Cerro Bellavista, Costa Rica. *Mycologia* 99: 534-543.

Schnittler, M. and Stephenson, S. L.
2000 Myxomycete biodiversity in four different forest types of Costa Rica. *Mycologia,* 92: 626-637.

Schnittler, M., Lado, C. and S. L. Stephensonn
2002 Rapid biodiversity assessment of a tropical myxomycete assemblage- Maquipucuna Cloud Forest Reserve, Ecuador. *Fungal Diversity* 9: 135-167.

Schnittler, M., Unterseher, M. and J. Tesmer
2006 Species richness and ecological characterization of myxomycetes and myxomycete-like organisms in the canopy of temperate deciduous forest. *Mycologia* 98:223-232.

Snell, K. L. and H. W. Keller
2003 Vertical distribution and assemblage of corticolous myxomycetes on five tree species in Great Smoky Mountains National Park. *Mycologi* 95: 565-576.

Stephenson S. L.
1988 Distribution and ecology of Myxomycetes in temperate forest.

I. Patterns of occurrence in the upland forests of southwestern Virginia. *Canadian Journal of Botany* 66: 2187-2207.

Stephenson, S. L.
1989 Distribution and Ecology of Myxomycetes in Temperate Forests. II. Patterns of occurrence on bark surface of living trees, leaf litter, and dung. *Mycologia* 81: 608-621.

Stephenson, S. L., Kalyanasundaram, I. and T. N. Lakhanpal
1993 A comparative biogeographical study of myxomycetes in the mid-Appalachians of eastern North America and two regions of India. *Journal of Biogeography* 20: 645-657.

Stephenson, S. L, & H. Stempen
1994 Myxomycetes A Handbook of Slime Molds. Timber Press Inc, USA.

Stephenson, S. L., Schnittler, M. and C. Lado
2004 Ecological characterization of a tropical myxomycete assemblage - Maquipucuna Cloud Forest Reserve, Ecuador. *Mycologia* 96: 488-497.

Tadiosa, E., Arsenio, J. J. and M. C. Marasigan
2007 Macroscopic fungal diversity of Mount Makulot, Cuenca, Batangas, Philippines. *Journal of Nature Studies* 6:111-124.

Tran, H. T. M., Stephenson, S. L., Hyde, K. D, and O. Mongkolporn. (2008). Distribution and occurrence of myxomycetes on agricultural ground litter and forest floor litter in Thailand. *Mycologia* 100: 181-190.

Tran, H. T. M., Stephenson, S. L., Hyde, K. and Orarat, M.
2006 Distribution and occurrence of myxomycetes in tropical forest of northern Thailand. *Fungal Diversity* 22: 227-242.

Uyenco, F. R.
1973 Myxomycetes of the Philippines. *University of the Philippines Natural Science Research Center Technical Report* 12: 1-23.

Wrigley de Basanta, D., Lado, C. and A. Estrada-Torres
2008 Morphology and life cycle of a new species of Didymium (Myxomycetes) from arid areas of Mexico. *Mycologia* 100: 921-929.