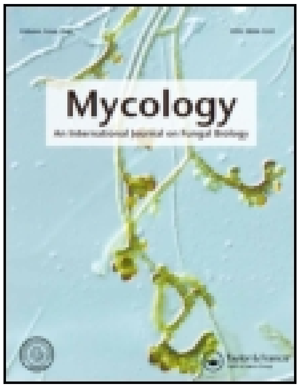

Mycology: An International Journal on Fungal Biology
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/tmyc20

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Available online: 28 Nov 2011

To cite this article: Nikki Heherson A. Dagamac, Steven L. Stephenson & Thomas Edison E. Dela Cruz (2012): Occurrence, distribution and diversity of myxomycetes (plasmodial slime moulds) along two transects in Mt. Arayat National Park, Pampanga, Philippines, Mycology: An International Journal on Fungal Biology, 3:2, 119-126

To link to this article: http://dx.doi.org/10.1080/21501203.2011.637088

Mycology
Vol. 3, No. 2, June 2012, 119–126

Occurrence, distribution and diversity of myxomycetes (plasmodial slime moulds) along two transects in Mt. Arayat National Park, Pampanga, Philippines

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(*Received 29 August 2011; final version received 11 September 2011*)

The Philippines has a poorly documented microbial flora and this is particularly true for myxomycetes. Thus, the research project described herein was carried out to assess the occurrence, distribution and diversity of the communities of myxomycetes in Mt. Arayat National Park. A total of 21 species representing 11 genera were recorded from substrates collected along two transects (Baño and Magalang) located in Mt. Arayat during the wet and dry season. Samples collected during the dry season, along the Magalang Trail, and aerial litter were the most taxonomically diverse, whereas the highest values for species diversity were observed for the Baño Trail, ground leaf litter and the dry season. Comparisons of the myxomycete communities yielded relatively high coefficient of community (CC) and percentage similarity (PS) values for the dry and wet seasons. This is the first study for the Philippines that has attempted to document the species composition of myxomycetes and their abundance in relation to the time of year they were collected, differences that exist between sites and substrates upon which these organisms occur.

Keywords: Mt. Arayat; myxomycetes; substrates; season; ecology; biodiversity

Introduction

The myxomycetes (also known as plasmodial slime moulds or true slime moulds) are a small, relatively homogenous group of phagotrophic fungus-like protists, with about 985 described species known worldwide (Lado et al. 2003). Studies of myxomycetes have been ongoing for more than 350 years. However, many of the more important ecosystems in the world have not been surveyed sufficiently for this group of organisms (Ing 1994; Spiegel et al. 2004; Ndiritu et al. 2009). Of particular interest are the different forest ecosystems in the tropics, particularly in Southeast Asia. Most species of myxomycetes appear to be cosmopolitan in distribution, but a number of species seem to be limited to tropical regions of the world (Tran et al. 2006). The Philippines, although considered one of the world's most biologically rich tropical countries, has received only limited studies of myxomycetes. Moreover, studies of Philippine myxomycetes have remained largely stagnant since those carried out in the 1970s (Reynolds and Alexopoulos 1971; Dogma 1975; Uyenco 1973). At that time, a total of 107 species of myxomycetes was known from the Philippines. These few published papers on Philippine myxomycetes have been checklists of species, with very little attention focused on the distribution and diversity of these organisms. Therefore, numerous gaps still remain with regard to our knowledge of these aspects of myxomycetes. One seemingly ideal study site is Mt. Arayat National Park, an isolated and dormant stratovolcano located in the plains of the Central Luzon Region. Rampant deforestation due to slash-and-burn farming and other human activities has resulted in only a few still intact forest patches in this area of the Philippines. However, in spite of its critical status, very limited studies have been carried out on its biodiversity, particularly the communities of myxomycetes present. The purpose of this paper is to assess the occurrence, distribution and diversity of myxomycetes in Mt. Arayat National Park.

Materials and methods

Study site

Mt. Arayat National Park (15°12′00″N 120°44′31″E/ 15.20°N 120.742°E) is located in the municipality of Arayat in the province of Pampanga, on Luzon Island in the northern Philippines. It is characterised by a mid-mountain forest type and reaches an elevation of 1027 m above sea level (masl). The area has an annual temperature range of 22–31 °C and an annual rainfall range of 284–1844 mm. The particular study site that yielded the data reported herein has a Type I climate characterised by

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ISSN 2150-1203 print/ISSN 2150-1211 online

http://dx.doi.org/10.1080/21501203.2011.637088
http://www.tandfonline.com

two pronounced seasons – dry from November to April and wet during the rest of the year. The mountain is topped by a circular volcanic crater about 1.2 km in diameter, much of which (especially the western part and part of the northern rim) has collapsed due to soil erosion. The main (elevation 1027 m) summit occurs on the northeast side of the breached crater (North Peak), while a secondary summit (elevation 984 m) is located on the southeast crater rim (Pinnacle Peak). Trails located on two slopes of the mountain served as the baselines for two transects, one (the Magalang Trail) on the northern side and the other (the Baño Trail) located on the southern side of the mountain. Both forest trails were located in a secondary deciduous type of forest, with species of *Musa*, *Ficus* and various dipterocarps representing the predominant trees present.

Collection, characterization and identification of myxomycetes

Samples of four different types of substrates (aerial and ground leaf litter, dead twigs and barks) were randomly collected along the two transects that extended up the mountain. These samples were then transported to the laboratory and used to prepare moist chamber cultures. The latter were maintained under diffuse light at room temperature (22–25 °C) for 8 weeks and checked every week for evidence (either plasmodia or fruiting bodies) of myxomycetes. All fruiting bodies that developed in the moist chamber cultures were removed and then allowed to air-dry gradually. Images of each of the specimens of myxomycetes collected were obtained using a Moticam 1000 (Motic, USA) camera. Gross morphological features were then determined under a dissecting microscope (Olympus, USA) at different magnifications. Microscopic characters were observed by preparing slides with material mounted in 95% ethanol and lactophenol, following the procedures described by Stephenson and Stempen (1994).

Analysis of occurrence, distribution and diversity of myxomycetes

Initially, percent yield was calculated for each collection site (transect) and substrate type to allow an overview of the possible distribution of myxomycetes in the two study sites and their respective productivity. A moist chamber culture that showed some evidence (either plasmodia and/or fruiting bodies) of myxomycetes was considered positive and thus was recorded as one positive culture. The number of positive cultures was determined and then divided by the total number of moist chamber cultures prepared. Species composition was initially determined for each collection site and substrate type, and then the occurrence of each species in each of the two collection sites and for each substrate type was determined. Occurrence refers to frequency, based on the presence or absence of a particular species of myxomycete. The relative abundance for every species of myxomycetes was then calculated and the species in question given an abundance index (AI) value. The AI was determined by assigning a "breaking point" based on their relative abundances (S.L. Stephenson 2011, pers. commun.). Taxonomic diversity was then calculated as the ratio of the number of species to the number of genera (S/G ratio). A value for the S/G ratio is inversely proportional to its taxonomic diversity; thus, the lower the S/G ratio, the more diverse a particular biota is considered. In measuring the taxonomic diversity of myxomycetes, a biota in which the species are distributed among a number of genera is intuitively more diverse than in a biota which the species belong to a few genera (Stephenson et al. 1993). Thus, a low S/G ratio value indicates a higher overall taxonomic diversity. Magurran (2004) supported this idea and stated that if two communities have identical numbers of species and equivalent pattern of species abundance but differs in the diversity of the taxa to which the species belong, it seems intuitively appropriate that the most taxonomically varied assemblage is considered as the more diverse. Earlier, Pielou (1975) stressed that diversity would be considered higher for a assemblage in which species are divided among many genera as opposed to one in which the majority of the species belong to the same genus.

To further quantify the myxomycete diversity in the two study sites, species diversity was also calculated using the different diversity indices provided in Magurran (2004). For example, the Gleason Index (H_G) measures species diversity in relation to species richness. Richness is defined as the variety of different species found in a biota. Pielou's species evenness index (E), on the other hand, quantifies how numerically equal communities are in a given sampling area. Shannon diversity index (H_S) measures species diversity with respect to both species richness and evenness. The latter index assumes that individuals are randomly sampled from an infinitely large community, and that all species are represented in the sample (Kumar and Hyde, 2004).These indices are computed as follows:

$$\text{Shannon Index of Diversity } (H_S) = -\Sigma_i (p_i \ln p_i) \quad (1)$$

where p_i = the total number of individuals in the ith species.

$$\text{Gleason Index } (H_G) = N_p - 1/\ln N_i \quad (2)$$

where N_p = the total number of species and N_i = the total number of individuals in the ith species.

$$\text{Pielou's index of species evenness } (E)\ E = H_S/H_{max} \quad (3)$$

where H_S = Shannon Index of Diversity and H_{max} = the maximum value of H_S.

Pairwise comparisons of the communities of myxomycetes associated with the two transects (Baño and Magalang) and the different substrates (AL, GL, TW and BK) were also carried out using the Sorensen's Coefficient of Community (CC) and the Percentage Similarity (PS) indices as described previously by Stephenson (1989). The Coefficient of Community (CC) index is based solely on the presence or absence of species in the two communities being compared (Stephenson et al. 1993):

$$\text{Coefficient of Community (CC)} = 2c/(a + b) \quad (4)$$

where a = total number of species in the first community being considered, b = total number of species in the second community and c = number of species common to both communities.

The values of CC range from 0 (when no species are present in both communities) to 1 (when all species are present in both communities). On the other hand, the Percentage Similarity (PS) index considers not only the presence or absence of species but also their relative abundance. PS values were calculated using the formula given below:

$$\text{Percentage Similarity (PS)} = \Sigma \min(a, b, \ldots x) \quad (5)$$

where min = the lesser of the two percentage compositions of species a, b, . . . x in the two communities. PS values range from 0 to 1, and a higher PS value indicates that the two communities being compared are more similar in terms of species composition and abundance.

Cluster analysis was also performed on the various data sets. Initially, the presence (1) or absence (0) of the collected species was noted in all the sites or substrates being compared. All of the species collected served as the total number of species present. Jaccard's coefficient values (J) between the communities being compared were then computed from the binary data sets using the Biodiversity Professional Ver. 2.0.

Results

Percent yield

A total of 696 moist chambers (MC) were prepared from substrates randomly collected from the two transects (Baño and Magalang) on the slopes of Mt. Arayat National Park in Pampanga during the wet and dry seasons. One hundred and fifty-nine (or 23%) of the MC were positive for myxomycetes, either as plasmodia (14%) or fruiting bodies (12%). Plasmodia (60%) were observed more often than fruiting bodies (53%), and some of these apparently did not develop further into mature fruiting bodies. The two transects on the slopes of Mt. Arayat were also compared for their respective yields of myxomycetes. Substrates collected during the dry season (32%) had more myxomycetes than substrates collected during the wet season (14%). Substrates collected along the Baño Trail were characterised by a higher yield (27%) than those collected along the Magalang Trail (18%). Among the four substrates collected, aerial leaf litter gave the highest yield of myxomycetes (32%), followed by ground leaf litter (24%), bark (18%) and twigs (17%).

Species composition and occurrence

Identification of the collected myxomycetes revealed that a total of 21 species belonging to 11 genera were collected from Mt. Arayat National Park. The 21 species were distributed among *Arcyria* (4 species), *Collaria* (1), *Cribraria* (1), *Craterium* (1), *Diachea* (1), *Diderma* (3), *Didymium* (2), *Licea* (1), *Perichaena* (1), *Physarella* (1), *Physarum* (4) and *Stemonitis* (1). The four species of *Arcyria* were *A. afroalpina, A. cinerea*, *A. insignis* and *A. pomi*formis, and the four species of *Physarum* were *P. cinereum, P. compressum, P. echinosporum* and *P. roseum*. Three species of *Diderma* (*D. effusum, D. hemisphaericum* and *D. subasteroides*) were recorded, along with two species belonging to the genus *Didymium* (*D. nigripes* and *D. squamolosum*). *Cribraria microcarpa, Craterium concinnum, Collaria arcyrionema, Diachea bulbillosa, Licea biforis, Perichaena depressa, Physarella oblonga* and *Stemonitis pallida* were the only representatives of their respective genera. *Arcyria cinerea* was the single most abundant species. When climatic conditions (wet season or dry season) were considered in the study, appreciable differences in species composition and abundance were noted. Eleven species were recorded during the wet season (October 2008), with a higher number (16) recorded during the dry season (February 2009). Six of the species collected (*A. cinerea, D. hemisphaericum, D. nigripes, D. squamolosum, P. echinosporum* and *S. pallida*) were recorded in both seasons. However, five species (A. *afroalpina, A. pomiformis, D. effusum, P. depressa* and *P. roseum*) were recorded only during the wet season, while ten species (*A. insignis, C. arcyrionema, C. microcarpa, C. concinnum, D. bulbillosa, D. subasteroides, L. biforis, P. oblonga, P. cinereum* and *P. compressum*) were restricted to the dry season. Sixteen species were recorded for the Baño Trail. *Arcyria cinerea* and *D. squamolosum* were abundant, while *D. hemisphaericum* and *D. squamolosum* were common. Twelve species were recorded as rare. For the Magalang Trail, a different pattern was apparent. Ten species were recorded from this site, but only one (*A. cinerea*) was abundant, with the others being rare. *Arcyria cinerea, Diderma hemisphaericum, Didymium nigripes* and *Stemonitis pallida* were recorded for both sites. The single most productive substrate was aerial leaf litter. Ten species (*A. cinerea, C. arcyrionema, C. concinnum, D. effusum, D. hemisphaericum, D. squamolosum, L. biforis, P. cinereum,*

Table 1. Abundance indices for species of myxomycetes recorded at different seasons, sites and substrates in Mt. Arayat National Park.

	Mt. Arayat National Park, Pampanga, Philippines							
	Season		Site		Substrate			
Taxon	Wet	Dry	Bano	Magalang	AL	GL	TW	BK
Arcyria afroalpina	R		R			R		
Arcyria cinerea	A	A	A	A	A	A	A	A
Arcyria insignis		R	R				O	
Arcyria pomiformis	R			R			O	
Collaria arcyrionema		R		R	O			
Cribraria microcarpa		R	R					R
Craterium concinnum		R	R		O			
Diachea bulbillosa		R	R					R
Diderma effusum	R		R		O	R		
Diderma hemisphaericum	C	C	C	R	C	A		
Diderma subasteroides		R		R				R
Didymium nigripes	R	R	R	R		C		
Didymium squamulosum	A	C	A		O	A		
Licea biforis		R	R		O			
Perichaena depressa	R		R			R		
Physarella oblonga		R		R				R
Physarum cinereum		R	R		O			
Physarum compressum		A	C	A	C	A	A	
Physarum echinosporum	A	R	C		O	A		R
Physarum roseum	R			R			O	
Stemonitis pallida	R	C	R	A			A	C

A = Abundant = ≥10% of the total collections.
C = Common = ≥5% but <10% of the total collections.
O = Occasional = ≥3 but <5 of the total collections.
R = Rare = <3% of the total collections.
AL = Aerial leaf litter; GL = Ground leaf litter; TW = Twigs; BK = Bark.

P. compressum and *P. echinosporum*) appeared on this substrate in moist chamber culture (Table 1).

Taxonomic diversity and species diversity

The taxonomic diversity and species diversity of myxomycetes for the two sampling sites in Mt. Arayat National Park during each of the two climatic seasons were also assessed. In the present study, 16 species belonging to 11 genera were recorded during the dry season, while only 11 species belonging to six genera were recorded for the wet season. As such, the dry season is then more taxonomically diverse than the wet season. To the best of our knowledge, most studies of the taxonomic diversity of myxomycetes have not considered its direct association with seasons, particularly those studies carried out in temperate forests. However, our results clearly indicated the effect of seasonality on the number of species and/or genera. Furthermore, when the collection sites were taken into consideration, the Baño Trail (16 species, 10 genera) had a higher number of species and genera than the Magalang Trail (10 species, 7 genera). Although higher numbers of species and genera were obtained for Baño, the S/G ratio was lower for Magalang, thus indicating a higher taxonomic diversity for this site. This is not surprising, because there were relatively fewer species recorded for Magalang, and the majority of these were rare species, which would have a significant influence on taxonomic diversity. In terms of substrates, the highest numbers of species and genera were observed for aerial leaf litter (10 species, 7 genera). The latter was followed by ground leaf litter (9 species, 5 genera). The lowest numbers of species and genera were noted on twigs (6 species, 3 genera). With seven different species belonging to seven different genera, bark would be considered the most taxonomically diverse of the four substrates. Most of the rare species encountered in the entire study was recorded from bark. When species richness and evenness were considered in the assessment of diversity, a different diversity pattern was noted for the two seasons and collection sites and among the four different types of substrates. To measure species diversity, several different diversity indices were also computed. In the present study, higher species diversity was observed during the dry season ($H_S = 0.92$) than during the wet season ($H_S = 0.89$). Analysis with the *t*-test (Magurran, 2004) showed that there was no significant difference between the H_S values of dry and wet seasons (p value $= 0.05$). When diversity values of the two collecting

Table 2. Taxonomic diversity and species diversity indices for myxomycetes collected at different seasons, sites and substrates in Mt. Arayat National Park, Pampanga.

	No. of Species	No. of Genera	S/G Ratio	H_S	H_G	E
Wet season	11	6	1.83	0.89	3.07	0.63
Dry season	16	11	1.45	0.92	3.85	0.54
Baño Trail	16	10	1.60	0.96	3.87	0.57
Magalang Trail	10	7	1.43	0.77	2.73	0.54
Aerial leaf litter	10	7	1.43	0.81	3.00	0.62
Ground leaf litter	9	5	1.80	0.86	2.46	0.61
Twigs	6	3	2.00	0.70	1.73	0.56
Bark	7	7	1.00	0.74	2.41	0.68

sites were compared, higher species richness ($H_G = 3.87$), evenness ($E = 0.57$) and diversity ($H_S = 0.97$) were noted for the Baño Trail than for the Magalang Trail. As regards to the different substrates, ground leaf litter had the highest value for species diversity, followed by aerial leaf litter, bark and twigs (Table 2).

Community analysis

When the myxomycete communities for the two collection seasons were compared, a CC value of 0.44 and a PS value of 0.53 were obtained. This means that almost half of all species were collected in both seasons. These were *A. cinerea, D. hemisphaericum, D. nigripes, D. squamolosum, P. echinosporum* and *S. pallida*. Some species were exclusive to a particular season. Five species were recorded only during the wet season and ten species were restricted to the dry season. Comparing the myxomycete communities for the two collecting sites, relatively lower CC (0.38) and PS (0.47) values were obtained. In contrast to seasons, fewer species were common to both collecting sites. Among the six species common to the two seasons, only five of these were recorded for both collecting sites. When the myxomycete communities associated with the different substrates were compared, the highest CC values (0.63) were for the communities on aerial leaf litter (AL) and ground (GL) leaf litter. This indicates a high level of similarity in species composition between these two substrates. A higher PS value was noted between aerial leaf litter (AL) and twigs (TW), which can be attributed to the high relative abundance of the species common to both substrates. However, since many species were rare on bark samples and only a few species recorded from twigs, it is not surprising that when these two substrates were compared with other substrates, their CC and PS values were relatively low. To further compare the communities of myxomycetes associated with the two collecting sites during the two different seasons, CC and PS values were also computed (Table 3). The results indicated that a higher similarity in myxomycete communities (CC = 0.40) was observed for substrates collected in the same site (Baño Trail) during the wet and dry seasons. Also, same CC value was noted for the myxomycete communities associated with the two different collecting sites (Baño and Magalang), but only during the dry season. In contrast, the myxomycete communities associated with the two collecting sites differed more (CC = 0.17) during the wet season. This can be accounted for by the low number of species recorded for the Magalang Trail during the wet season. When the relative abundance of each species is considered in addition to the overall species composition of the communities being compared, (i.e. the percentage similarity [PS] values), a similar pattern with respect to CC values was observed (Table 3). A higher percentage similarity value (PS = 0.56) was observed for substrates collected along the Baño Trail and the Magalang Trail during the dry season. In a similar fashion, a high value (PS = 0.54) was recorded for the myxomycete communities associated with substrates collected along the Baño Trail during the wet and dry seasons. The high number of myxomycetes recorded during the dry season may explain this observed trend. To further show the similarities between the different communities of myxomycetes, cluster analysis was also performed using the Jaccard's index. In this analysis, myxomycete communities associated with the Baño Trail clustered together, regardless of

Table 3. Sorensen's coefficient of community (lower left) and percentage similarity (upper right) values for myxomycetes from two sites during the wet and dry season.

	WET		DRY	
	Baño Trail	Magalang Trail	Baño Trail	Magalang Trail
WET				
Baño Trail		0.29	0.54	0.38
Magalang Trail	0.17		0.37	0.54
DRY				
Baño Trail	0.40	0.25		0.56
Magalang Trail	0.38	0.33	0.40	

the collecting season. This cluster analysis further supports the results of the CC values, for which the myxomycete communities associated with the Baño Trail during the two seasons showed the highest CC value (0.40). Cluster analysis also grouped these communities with the myxomycete communities associated with the Magalang Trail during the dry season. It is also not surprising that the myxomycete communities associated with the Magalang Trail during the wet season displayed the greatest separation, since these had the fewest numbers of myxomycetes. When cluster analysis was carried out with respect to myxomycetes and the substrates on which they occurred, aerial leaf litter and ground leaf litter grouped together. In addition, twigs and bark also clustered together, indicating similarities in their associated myxomycete communities. Perhaps the food source (i.e. bacteria and other microbial flora) found on leaf litter, regardless of its location (on the ground or above ground), was abundant enough and/or similar enough in composition to support similar species of myxomycetes.

Discussion

The present study assessed the diversity and occurrence of myxomycetes associated with samples collected from transects established along two trails (Baño and Magalang) in Mt. Arayat National Park during the wet and dry seasons. A total of 696 moist chambers were prepared from the four types of substrate, and a relatively low percent yield (23%) of myxomycetes was obtained. These result were comparable to the same low productivity noted for samples of substrates collected in different part of Luzon Island (Corpuz et al. 2009; Dagamac et al. 2010), Nevertheless, the overall value in using moist chamber cultures to assess the diversity of myxomycetes had been demonstrated in numerous studies (e.g. Harkonen, 1981; Stephenson, 1989; Lado et al. 2003; Wrigley-de Bassanta et al. 2008, Kilgore et al. 2009).

As regards to seasonal distribution, the dry season was characterised by a higher myxomycete yield and, thus, was more diverse than the wet season. These results are different than those reported by Rojas and Stephenson (2007), who observed higher species diversity during the wet season than the dry season for a study area (Cello Bellavista) in Costa Rica. Changes in species composition and abundance of myxomycetes are to be expected for every season (e.g. Stephenson, 1988; Novozhilov et al. 2003). As such, the patterns observed in the present study were similar to those observed in other studies (Schnittler and Stephenson, 2000; Rojas and Stephenson, 2007; Novozhilov and Schnittler, 2008). Interestingly, one important factor accounting for this variation in the tropics appears to be temperature (Maimoni-Rodella and Gottsberger, 1980). This was suggested to be the case by Ogata et al. (1996), when they found that slight changes in temperature during any season appeared to be responsible for the observed changes in community composition. In their study, they observed a positive correlation between precipitation and temperature and the overall abundance of myxomycetes.

The Baño Trail also had a higher myxomycete yield than the Magalang Trail. In terms of taxonomic diversity, Magalang was more diverse, but when species diversity (richness and evenness) was considered, the Bano Trail was actually more diverse. In general, both trails are affected by anthropogenic activities (i.e. many areas have been subjected to slash-and-burn farming [kaingin]). However, the denuded forest is more prominent on the Magalang Trail due to the conversion of land to agricultural farms and residential areas. This might have an effect on the diversity and distribution of myxomycetes, although there are no comparable studies that have reported the direct influence of man-made activities on myxomycete yield. As similarly observed by Eliasson and Nannenga-Bermekamp (1983), the communities of species present and their relative abundance tend to vary from one place to another; as already noted, differences in species composition and abundance were apparent on the two slopes of Mt. Arayat.

Among the four types of substrates, aerial leaf litter (32%) was characterised by the highest myxomycete yield. Aerial leaf litter was also the most taxonomically diverse among the four substrates. The results reported herein were comparable to those obtained in studies of leaf litter carried out in Puerto Rico, Costa Rica and several high-latitude regions in the Northern Hemisphere (Novozhilov et al. 2000; Rojas and Stephenson, 2008; Stephenson et al. 2000). It is generally assumed that wind plays a major role in dispersing the spores of myxomycetes and, thus, could be responsible for the higher yield often reported from aerial litter. Schnittler et al. (2006) demonstrated that even a slight breeze can cause myxomycete spores to be dispersed more than 1 km from their point of origin. Stephenson et al. (2008) also noted that in tropical forests, myxomycete biodiversity seems to be greatest in aerial microhabitats in contrast to temperate forests, where the greatest myxomycete diversity tends to be associated with the forest floor. Different types of substrates (often considered as representing different microhabitats) can also influence myxomycete distribution (Novozhilov, 2000). Schnittler and Stephenson (2002) described this microhabitat as a microecosystem (i.e. a small specialised habitat within a larger habitat). The type of substrate also can also be used to describe the general ecological group to which a particular species of myxomycete belongs (Ing, 1994). For example, corticolous myxomycetes are those species that complete their life cycle on the bark of living trees and vines (Keller and Braun, 1999; Everheart and Keller, 2008). Lignicolous (wood-inhabiting) and follicolous (leaf litter-inhabiting) myxomycetes are found on decaying plant substrates on the ground (Ing, 1994). Schnittler and Stephenson (2002) collected floricolous myxomycetes from the infloresecences of Neotropical herbs. Kosheleva et al. (2008) noted variations in myxomycete composition among substrates collected in Stolby, Russia. They reported that bark samples had the highest species richness. However, their bark samples supported the least specific myxomycete communities, whereas litter and dung, though characterised as the poorest, had the most specific communities. Relatively, very few studies have examined the ecological association of particular species of myxomycetes with certain type of substrates (Tran et al. 2006). Stephenson (1989) studied the communities of myxomycetes associated with the bark microhabitats from 13 different species of trees and concluded that different tree species supported quite different communities of myxomycetes. Stephenson (2003) also reported that many species of the species commonly collected from palm fronds were encountered rarely or not at all on other substrates in the same locality. Clearly, myxomycetes are not found with equal abundance on all of substrates potentially available to them. All of the substrates used in the present study were decaying organic matter. This affirms the general assumption that myxomycetes, regardless of the type of substrate being considered, are common inhabitants of various kinds of decaying plant material in a forest ecosystem (Schnittler and Stephenson, 2002).

Most of the specimens recorded in this study had been previously reported from the Philippines (Reynolds, 1981). These species came from different sites throughout the country, but none of these was in Pampanga. As such, the species of myxomycetes listed herein are now reported for the first time from Mt. Arayat National Park. However, some species (e.g. *Arcyria pomiformis*) were reported recently from Laguna and Cavite (Corpuz et al. 2009). Two other myxomycetes (*Stemonitis pallida* and *Diderma subasteroides*) were also reported recently as new records for the country and noted as corticolous myxomycetes on the bark of *Samanea saman* in Quezon City and Zambales (Dagamac et al. 2010). Interestingly, four of the species (*Arcyria afroalpina*, *Collaria arcyrionema, Craterium concinnum* and *Licea biforis*) listed herein are reported as new records for the country. Ndiritu et al. (2009) also noted the abundant occurrence of *A. cinerea* together with other species such as *Didymium annellus, D. squamolosum, Echinostelium minutum, Physarum bivalve, P. cinereum, P. notabile* and *Stemonitis herbatica,* in different vegetation types in Big Bend National Park in the USA. Tran et al. (2006) also recorded *A. cinerea* from all their study plots. The species was reported as abundant on all substrates collected in the tropical rainforest of northern Thailand. In the Neotropics, *A. cinerea* was reported as abundant, along with a number other species belonging to the order Physarales (Stephenson et al. 2004). However, Dagamac et al. (2010) noted that *A. cinerea* was rare on bark substrates. Two species (*D. squamolosum* and *P. compressum*) were reported as abundant, whereas three species (*D. hemisphaericum, P. echinosporum* and *S. pallida*) represented $\geq$5% but $<$10% of the total collections and, thus, were recorded as common. All of these species were reported as cosmopolitan. Most species (15) were represented $<$3% of the total collections and, thus, were rare. Species often recorded as rare in the tropics include *Collaria arcyrionema, Diachea bulbillosa* and *Physarella oblonga* (Tran et al. 2006). Interestingly, some of the rare species on Mt. Arayat are often reported as abundant or common in temperate regions of the world. Example include *P. depressa, P. cinereum* and *D. effusum*, which were abundant in Big Bend National Park in the USA and in five different study sites in southwestern Virginia (Stephenson et al. 1989; Ndiritu et al. 2009). Consequently, the present study affirms the differences in species composition and abundance that seem to exist between two distinct ecoregions of the world – the temperate zone and the tropics. Many of the major studies of species composition and occurrence of myxomycetes have been carried out in temperate forests and in Neotropic forests. For example, Stephenson et al. (2001) provided a checklist of 168 species of myxomycetes for the Great Smoky Mountain National Park in USA, based on records accumulated over a period of 17 years. In the Philippines, comparable studies have yet to be carried out, but the present study represented the first effort to compare species composition and patterns of occurrence among seasons, sites and substrates in the Philippines.

Acknowledgements

This research work is supported by Studienstiftung Mykologie through the generosity of Professor Dr Walter Gams. This is also partly funded by the graduate research grant given by the Department of Science and Technology – Philippine Council for Health Research and Development (DOST – PCHRD) and by the research grant provided by the Research Center for the Natural and Applied Sciences, University of Santo Tomas. NHAD acknowledges Rogelio T. Trinidad and Regidor M. de Leon, Department of Environment and Natural Resources (DENR) – Region III, for granting us of a permit to collect specimens in Mt. Arayat National Park.

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