BRENESIA 73-74: 39-57, 2010

A review of the Costa Rican myxomycetes (Amebozoa)

Carlos Rojas[1-2], Martin Schnittler[3] & Steven L. Stephenson[2]

[1.] Escuela de Biología, Universidad de Costa Rica, San Pedro de Montes de Oca, 11501 - Costa Rica.
[2.] Department of Biological Sciences, University of Arkansas, Fayetteville AR 72701, United States.
crojas@isic.org; slsteph@uark.edu
[3.] Botanical Institute and Botanical Garden, Ernst-Moritz-Arndt University Greifswald, Grimmer Str. 88, D-17487 Greifswald, Germany. martin.schnittler@uni-greifswald.de

(Received: March 18, 2010)

ABSTRACT. There has not been a comprehensive review of the taxonomic composition of the assemblage of myxomycetes known from Costa Rica since 1975. As a result of a series of studies carried out in the country during the last decade, considerable additional data now exist, and the review presented herein provides an update on this group of organisms. Collecting carried out in Costa Rica since 1975, a review of the published literature, and an examination of herbarium specimens were used to generate an annotated list consisting of a total of 208 species in 36 different genera. This includes 62 species not previously reported from Costa Rica. The relative abundance of the different orders follows the expected distribution for the Neotropics, with the order Physarales being the most abundant. Interestingly, the data also show that the distribution of species is highly heterogenous. This result suggests that most myxomycetes in Costa Rica are highly specialized for certain microhabitats defined by macro- and microenvironmental factors.

RESUMEN: Desde 1975 no se ha llevado a cabo una revisión exhaustiva de la composición taxonómica de los mixomicetes de Costa Rica. Como resultado de una serie de proyectos de investigación que se han desarrollado durante la última década, nueva información se encuentra disponible y es por ello que la presente revisión se considera como una actualización sobre este grupo de organismos para este país. El material recolectado desde 1975, una profunda revisión bibliográfica y el examen de especímenes de herbario fueron usados para generar una lista de 208 especies pertenecientes a 36 géneros diferentes. Esta lista incluye 62 especies no comunicadas anteriormente para Costa Rica. La abundancia relativa de los diferentes órdenes concuerda con la distribución esperada para el Neotrópico, siendo el orden Physarales el más abundante. De forma interesante, los datos también muestran que la distribución de las especies es altamente heterogénea. Este resultado sugiere que la mayoría de los mixomicetes en Costa Rica están altamente especializados alrededor de microhabitats definidos por factores macro y microambientales.

KEY WORDS. biogeography, Central America, mycetozoans, myxogastrids, Neotropics

The myxomycetes (plasmodial slime molds or myxogastrids) are a group of ameboid protists (Adl *et al.* 2005) known to occur in all terrestrial ecosystems examined to date. As a group within the Amebozoa (Pawlowski & Burki 2009), myxomycetes have a unicellular amoeboid or flagellated vegetative stage in which they resemble other amoebae. In contrast, however, their life cycle also includes the particular capacity to produce unicellular multinucleate structures known as plasmodia but also fungus-like fructifications that contain meiotic spores (Stephenson & Stempen 1994).

This combination of morphologically different stages gives myxomycetes a high theoretical capacity for dispersal and colonization (Schnittler & Tesmer 2008). Interestingly, it seems that the ability of myxomycetes to perform these tasks depends largely on individual requirements of the species and pre-existing ecological conditions. For example, recent studies in the Neotropics have indicated that a particular species seems to be associated with a microhabitat defined by a series of discrete ecological parameters and that these microhabitats vary among taxa (e.g. Schnittler & Stephenson 2002, Rojas & Stephenson 2007, Wrigley de Basanta *et al*. 2008). Because of this, myxomycetes are not homogeneously distributed with respect to either macro- or microenvironmental factors. If this is in fact a biological pattern, then different geo-climatic areas would potentially support different myxomycete assemblages. Interestingly, for the Neotropics, this seems to be the case (e.g. Stephenson *et al.* 2004).

Costa Rica is a good example of an area in which previous studies have also shown that the distribution of species of myxomycetes seems to be ecosystem-related (e.g. Schnittler & Stephenson 2000). However, the lack of a long-term dataset of myxomycetes and information on their distribution patterns across various environments in this country has reinforced the speculative distributional ranges usually cited for particular species. This problem, also common in other areas of the Neotropics, represents an obstacle that has to be taken in consideration when attempting to elucidate the actual distributions of particular species of myxomycetes. In an effort to standardize the degree of knowledge relating to Neotropical myxomycete taxa, Lado & Wrigley de Basanta (2008) compiled a large set of records from the literature to generate an updated list of myxomycete species and their distribution in the Neotropics. The last occasion when a similar project had been carried out was in 1976, when Marie L. Farr published her monograph on Neotropical myxomycetes (Farr 1976). Unfortunately, due the limitations of the research methodology used in both instances, it is very likely that a number of non-published records, including collections in small herbaria, were left out of the list as part of the effort involved in each of these projects.

When the latter point is considered along with the additional fact that the last comprehensive study dealing with myxomycetes in Costa Rica was carried out more than 30 years ago (Alexopoulos & Sáenz 1975), it seems worthwhile to evaluate the progress that has been made in the country since then. For this reason, the study presented herein was designed with two main objectives. The first was to review the list of myxomycete species reported from or known to occur in Costa Rica and the second was to provide basic ecological information for each taxon. For example, myxomycetes seem to have an important role in the soil environment (Novozhilov *et al*. 2000), but developing a good understanding of their ecology and interspecific relationships is not possible without having a good taxonomic baseline already in place.

MATERIAL AND METHODS

The information presented in this paper was generated at different times during the period of 1905 to 2009. The specimens considered herein were collected by a number of different individuals using different methodologies. However, the methods used to compile information for this paper have been carefully selected. For example, the nomenclatural treatment used for all myxomycete species is that of Lado (2005-2010) except for *Stemonitis smithii* and the genus *Tubifera*, for which the treatment of Martin & Alexopoulos (1969) has been used. Synonyms are provided for species that were reported previously for Costa Rica under a different name. Following Lado (2005-2010), synonyms are specified with the symbols □ (homotypic) and = (heterotypic). All identifications noted for particular specimens are based on the morphological species concept (see Clark 2004 for a discussion of shortfalls and problems).

Compilation of the annotated checklist. The information presented in this paper was compiled from a number of sources, with the more important to these being (1) Hennings 1902, (2) Welden 1954, (3) Alexopoulos & Sáenz 1975, (4) Farr 1976, (5) Schnittler & Stephenson 2000, (6) Moore & Stephenson 2003, (7) Rojas & Stephenson 2007, (8) Rojas & Stephenson 2008, (9) Rojas *et al*. 2008, (10) Lado & Wrigley de Basanta 2008 and (11) Moreno *et al*. 2009. The number preceding each of these published reports represents the code used in the annotations for given for each taxon.

All species names were obtained from the sources mentioned above and then used to create a preliminary list of Costa Rican myxomycetes in a manner similar to what has been done in a recent previous publication (i.e., Lado & Wrigley de Basanta 2008). However, in addition to published records, myxomycete collections in five herbaria were examined. These herbaria (acronyms given in parentheses) were the Museo Nacional de Costa Rica (CR), the Universidad de Costa Rica (USJ), the University of Arkansas (UARK), the United States National Fungus Collection (BPI) and the Botanische Staatssammlung München (M). The selection of these five herbaria was based on the fact that they were designated as the primary repositories for specimens obtained during the course of important research projects carried out in the country, including seven that were described in the publications listed above. With the exception of most collections deposited in BPI, all the collections in the other herbaria were examined directly. In addition, as an extra source of information, the electronic portal of the Global Biodiversity Information Facility (GBIF), was used to validate some of the records. Locations of all collecting areas represented in this survey are indicated in Fig. 1.

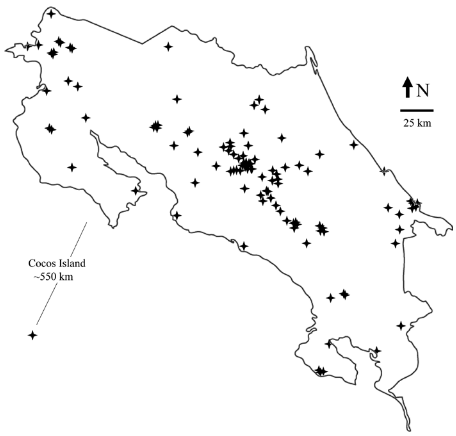


Figure 1. Map of Costa Rica showing collecting locations for the records considered in the present study.

All species reported herein are supported by either deposited vouchers at the studied herbaria or listed in previously published reports. However, four doubtful species for which no vouchers or published reports were found are included, although their occurrence in Costa Rica remains uncertain.

Field work. On different occasions during the period 1994-2009, the three authors carried out field work in Costa Rica. During this time, a combination of field and laboratory techniques was been used. For the former, specimens were collected directly in different vegetation zones in the country using the opportunistic sampling method described by Cannon & Sutton (2004). Upon being collected, specimens were glued to a paper strip, dried at room temperature and placed in pasteboard boxes using the protocol described by Stephenson & Stempen (1994).

For the laboratory component, samples of different types of dead plant material were collected in the field and used to prepare several series of moist chamber cultures. The latter consisted of plastic disposable Petri dishes (15 cm) lined with filter paper. Sample material was placed on the filter paper and soaked in distilled water for 24 hr, after which excess water was poured off. Examination of cultures was carried out at different times for a period not longer than four months. Substrates used to obtain myxomycetes in this manner included ground litter, aerial litter (as described in Stephenson *et al*. 2004), wood and bark, twigs, flowers and inflorescences, fruits and dung.

Classification of species. In order to evaluate the occurrence of myxomycetes according to forest type and substrate, a frequency-based classification of records was carried out on the main database following the methods described by Stephenson *et al*. (1993). In this classification, the frequency of occurrence of each one of the species in relation to the different forest types and substrates was evaluated in relation to the total number of records with available information for each factor. In this manner, species with occurrences higher than 1.5% the total number of records were considered as abundant, those between 1.5-0.5% as common, between 0.5-0.15% as occasional and less than 0.15% as rare. Only the values for the abundant and common categories were used to determine forest type and substrate preference. For those species in which the number of records for the country is very low, all available information was used.

Forest types and substrates. To determine forest type and substrates, a careful examination of records following the methodology detailed in Rojas *et al*. (2009) was carried out. In the first instance, all geographical coordinates were first checked for consistency and accuracy. Forest types were assigned to collections by performing a GIS analysis using ARCMap, version 9.2 and the Holdridge Life Zone system (Holdridge *et al*. 1971).

With this system, forests are classified according to environmental criteria such as elevation, biotemperature and evapotranspiration values. When arranged along a gradient of precipitation from highest to lowest, the forest types in which myxomycetes were found in Costa Rica correspond to premontane rain forest (PRF), lower montane rain forest (LMRF), montane rain forest - transition to lower montane (MRFTLW), montane rain forest

(MRF), subalpine rain paramo (SRP), premontane wet forest - transition to perhumid (PWFTp), lowland wet forest (LWF), lowland wet forest - transition to premontane (LWFTP), premontane wet forest (PWF), premontane wet forest - transition to lowland (PWFTL), lower montane wet forest (LMWF), lowland moist forest (LMF), premontane moist forest - transition to lowland (PMFTL), premontane moist forest (PMF), lowland moist forest - transition to premontane (LMFTP), lower montane moist forest (LMMF), lowland moist forest - transition to dry forest (LMFTd) and lowland dry forest (LDF). The letter codes assigned to each forest type are used in the annotations for each species.

For substrates, a series of 10 categories was first created based upon the original recorded substrates available in the main database and then individual records were re-arranged into these newly created categories. From non woody to increasingly woody, the substrate categories correspond to dung (DU), flowers and inflorescences (FI), living plants (LP), living cryptogams, (LC), ground litter (GL), aerial litter (AL), lianas (LI), fruits (FR), twigs (TW) and dead bark and wood (DBW). In a manner similar to what was described in the previous section, the letter codes assigned to each substrate category were used for the annotations of species.

Annotations and format of the list of species. The list of species is arranged alphabetically and for each taxon a number of annotations have been included. In all cases, after the species name, the forest and substrate types where the species predominantly occur are provided using the letter codes explained earlier. This is followed by the publications listed above where the species was mentioned, which are provided as a series of numbers that correspond to the number codes for these information sources. After this, the codes for the herbaria where vouchers are deposited, the relative abundance of the species in the entire country (based upon the categories explained above) and also in other Neotropical countries where the species has been recorded are provided as well. Species names that represent new records for Costa Rica are preceded by an asterisk, whereas those that are also new for the Neotropical region are preceded by two consecutive asterisks. For the four doubtful species, a question mark precedes the taxonomic name. The protologues for species are provided only in those instances in which the treatment of Lado (2005-2010) was not followed.

Data analysis. As a way to evaluate the taxonomic richness of the studied area, the taxonomic diversity index *sensu* Stephenson *et al*. (1993) was calculated by determining the ratio between the numbers of species and the number of genera recorded. This index is useful when estimating the intrageneric diversity of a given area, in the framework of biogeographical studies.

Similarly, in order to estimate the maximum number of species to be expected in the country, species richness indicators were calculated using the program SPADE (Chao & Shen, 2003). The values corresponding to the ACE estimator recommended by Chao *et al*. (2006) were selected after running a simulation using the multinomial predictive model. Following this calculation, the completeness of the survey was estimated from the relationship that existed between the number of species found in the database created and the expected value obtained with SPADE. In addition, a species accumulation curve was generated and adjusted using the formula provided by Raaijmakers (1987). Using this same formula, a calculation of the maximum number of species was carried out as well. Rarefaction-based species accumulation curves were not generated in the present study because of the exceedingly heterogeneous nature of the dataset.

Records in the dataset were arranged on the basis of the elevational floor (i.e., elevation range) at which they were found. For this, all collecting areas in the range between 0-750 m were considered as lowlands, those areas higher than 750 m but lower than 1 500 m were considered to belong to the premontane floor and those higher than 1 500 to the montane floor. A series of Pearson's Chi square tests of Goodness of Fit were performed to evaluate statistical differences in the number of species found in the 10 forest types with the highest number of species and the number of species found in the three substrates with the highest species richness. Similar tests were carried out to evaluate differences that existed for species richness and average number of records in relation to elevational floors. In all cases a Monte Carlo simulation was used to evaluate possible problems in the original values used during the Chi-Square tests. The program PAST, version 1.92 (Hammer *et al*. 2001) was used for these calculations.

RESULTS

The final database of all myxomycete collections in the country included 4990 records. These records were derived from a representative sample of forest types and localities throughout Costa Rica (including Cocos Island, Fig. 1). Altogether, the database contained 208 species in 36 different genera and 62 species not previously reported for this country as well as 7 species not previously reported for the Neotropics. Three more taxa are presumed to be in the country but their presence is still uncertain. These numbers generate an overall taxonomic diversity index value of 5.77. An appreciable proportion of the species in the country belong to the order Physarales, the group that included the two genera (*Physarum* and *Didymium*) with values for highest species richness (Fig. 2).

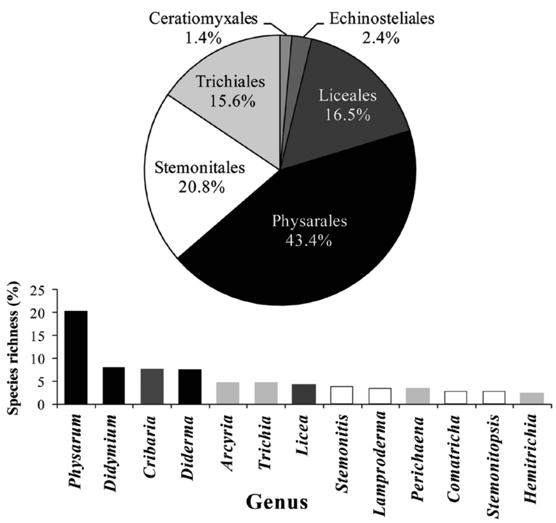


Figure 2. Taxonomic composition of the assemblage of myxomycetes reported from Costa Rica. Distribution by orders (above) and genera (below), with highest species richness sorted by decreasing values from left to right.

The ACE value for the maximum number of species to be expected, based on the entire dataset, was 253 species, with a 95% confidence interval between 232-291 species. According to this value, about 83% of the species of myxomycete that would be expected to occur in Costa Rica are reported herein. A similar pattern is apparent for the species accumulation curve (Fig. 3). However, with this calculation, the maximum number of species to be expected was 214 taxa.

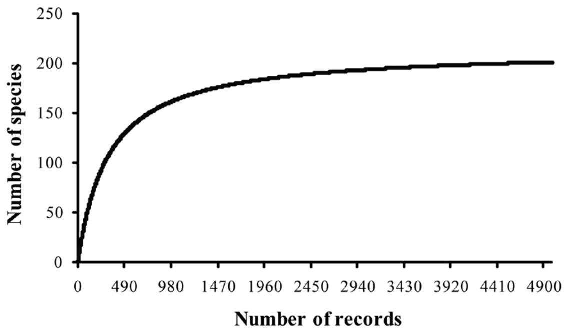


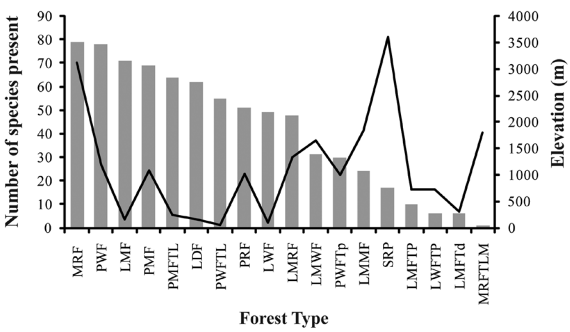
Figure 3. Species accumulation curve based on the dataset compiled during the present study. According to Raaijmakers (1987), the maximum number of species is determined by the parameter *a* in the formula $y= ax/(b+x)$.

The forest types with the most species present were montane rain forest, premontane wet forest, lowland moist forest and premontane moist forest, whereas some of the transitional forest types showed the lowest values of species richness (Fig.4). The data suggest that there are differences in the number of species present in the ten most represented forest types ($X^2 = 19.33$, d.f. = 9, $P<0.05$; Monte Carlo $P < 0.05$). When the analysis was carried out in terms of elevational floors, no differences were apparent for the number of species present at the different elevations (see Fig. 5, $X^2 = 3.54$, d.f. = 2, $P = 0.17$), but the average number of records per species was significantly higher in lowlands ($X^2 = 13.87$, d.f. = 2, $P < 0.001$). Interestingly, the numbers of singletons for the different elevational floors were 32, 36 and 41 for lowlands, premontane and montane areas, respectively.

Similarly, dead bark and wood and the two types of litter studied were the substrates with the highest number of species, whereas dung, lianas and fruits fall towards the other extreme of the distribution (Fig. 6). For the three substrates characterized by the most species of myxomycetes, it seems that the one represented by dead bark and wood is the one that supports the largest myxomycete community (X^2 = 29.68, d.f. = 2, p<0.0001; Monte Carlo p < 0.0001).

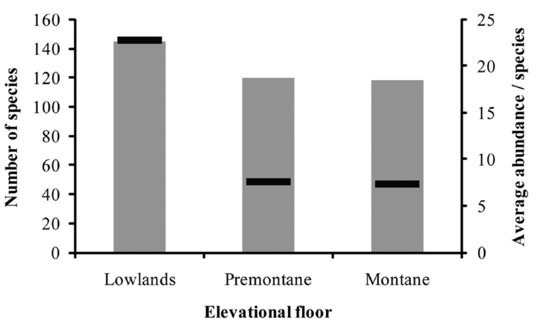
The most common species in the dataset were *Arcyria cinerea*, *Physarum compressum*, *Didymium iridis* and *Didymium squamulosum*. The annotated list of all species documented for Costa Rica is provided below.

Figure 4. Number of species of myxomycetes found



(gray bars) and elevation (black line) arranged according to the different forest types found in Costa Rica. For abbreviations see Materials and Methods.

Figure 5. Numbers of species of myxomycetes (gray



bars) and average numbers of records per species (black thick lines) recorded at the three different elevational floors considered in the present study.

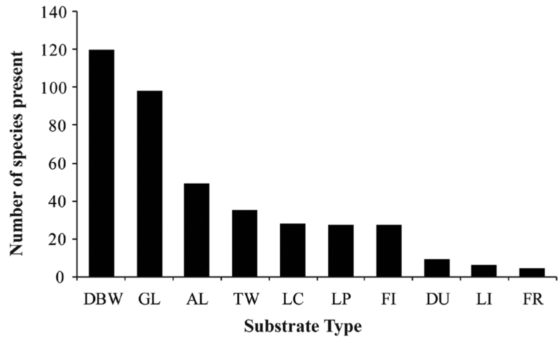


Figure 6. Number of species of myxomycetes found in the different substrate types evaluated in the present study. For abbreviations see Materials and Methods.

DISCUSSION

The comprehensive database of myxomycete collections compiled for this paper is largely the product of field studies carried out in Costa Rica during the past decade (see Rojas *et al*. 2009). It is not surprising that a high percentage of the species reported herein have not been included in recent publications. For example, about ten years ago Schnittler & Stephenson (2000) increased the number of known species for this country to 126, and just recently Lado & Wrigley de Basanta (2008) reported a total of 143 species in their recent literature review. However, field surveys carried out during the past decade in areas of the country traditionally understudied have yielded a number of species not previously known for these areas. In fact, if the four doubtful species are considered, the total number of myxomycetes for Costa Rica would increase to 212 species.

All these values are close to the maximum number of species to be expected as calculated using the species accumulation curve. However, this number should be higher if the diversity prediction using ACE values is correct. The completeness of the survey is calculated as more than 80% using this indicator. However, it is important to remember that variations in the calculation of the maximum number of species occur when different algorithms are used (see Magurran 2004). As such, the estimate provided herein is not intended to be considered as a "definite" calculation. Moreover, the apparent underrepresentation in the overall abundance noted for some of the more common species undoubtedly reflects the fact that some researchers do not collect these species more than a couple of times in an ordinary survey; which affects the calculation of the maximum number of species. In addition, the absence of rarefaction-based species accumulation curves, because of the limitations of the database, do not allow a proper evaluation of this parameter.

Even when the results obtained previous studies are considered, it is difficult to evaluate this parameter. For instance, Schnittler & Stephenson (2000) calculated that between 70-80% of the myxomycetes on bark and litter in different forest types in Costa Rica were recovered in their study by using a different estimator. Similarly, Schnittler *et al*. (2002) calculated the completeness of a rapid assessment project in a cloud forest in Ecuador as about 92%. However, the values from those projects may reflect the limitations of the research carried out. With only a restricted number of populations of amoebae forming fructifications at a given time, and the well-known fact that many species, especially those forming large fructifications, hardly occur in moist chamber cultures, these surveys represent only "snapshots" of biological systems and do not necessarily reflect the total species assemblage of a particular area. Almost always such rapid assessments underestimate the species richness of an area as a product of their temporally limited research effort. Given this scenario, it is still hard to determine if the completeness of myxomycete surveys accurately reflect a biological pattern. However, it is very likely that the number of species of myxomycetes reported for Costa Rica in this paper reflects the majority of the taxa actually present in the country.

In any case, one aspect that should be taken in consideration is the taxonomic treatment that authors have used to report myxomycetes from Costa Rica. Until recently, most taxonomic treatments primarily followed Martin & Alexopoulos (1969). However, in recent years the treatments of Lado (2001) and Lado (2005-2010) have been incorporated into publications related to Costa Rican myxomycetes. Due this discrepancy, the synonymies of the names reported herein have been included. In any case, species such as *S. smithii* T. Macbr. and *Cr. oregana* H.C. Gilbert have been treated separately. In the first instance, this species is not reported in Lado & Wrigley de Basanta (2008) since, according to the treatment of Lado (2005-2010), the taxon in question should be included in *S. axifera* (Bull.) T. Macbr. For the purpose of the present paper, *S. smithii* is considered a separate taxon. In the case of *Cr. oregana*, this species was reported in Lado & Wrigley de Basanta (2008); however, no vouchers or reports of this species were found during the course of this investigation. For that reason, this taxon was not included in the current list.

One aspect of interest is the high value for the taxonomic diversity index. For comparison, the value obtained by Stephenson *et al*. (1993) from an analysis of the data given by Alexopoulos & Sáenz (1976), also in Costa Rica, was only 3.93. This type of data shows the importance of nearly exhaustive surveys, since it is obvious that this aspect can invariably modify the value of taxonomic diversity, depending upon how exhaustive an area has been examined.

Interestingly, the high value of intrageneric diversity obtained herein can also be used to infer ecological aspects of the community under study, especially at the resource partitioning level. It is known that when a number of closely related species are present in an area with limited resources, the common outcomes are competitive exclusion and evasion of competition by resource use specialization (see Morin 1999). In this sense and given the high taxonomic diversity value obtained in this study, it is not surprising that *Physarum* and *Didymium*, the two genera with the highest numbers of species were the ones with a higher presence across substrates and forest types (not previously shown). This might indicate these genera utilize a wide range of resources, which is possible when species use different resources in different ways.

In this sense, the differences in species richness and species assemblages (see Rojas *et al*. 2009) between different forest types and substrates might reflect the same pattern of niche separation by means of resource partitioning. This seems to be a common phenomenon in tropical myxomycetes, for which evidence has been provided recently by several authors (e.g. Schnittler 2001, Schnittler & Stephenson 2002; Rojas *et al*. 2008; Wrigley de Basanta *et al*. 2008; Estrada-Torres *et al*. 2009). These data suggest that the complex mosaic of microenvironments found in tropical forests provides myxomycetes with a number of exploitable niches that seem to have driven particular species to a degree of specialization that is not found in other types of ecosystems. In spite of this apparent pattern, the data provided in this paper are not conclusive for the majority of the species due the low number of records for an accurate ecological analysis.

It is clear however, that some of the most common species of myxomycetes in Costa Rica are present in a large number of forest types and substrates. In almost every survey carried out in this country, species such as *A. cinerea*, *H. calyculata*, *D. squamulosum* and *Ph. compressum* were found. This contrasts with the situation that exists for species that belong to such genera as *Lamproderma* and *Trichia*, for which high-elevation forests and dead bark and wood seem to be the preferred combination of forest type and substrate for example. Of course, this is definitely an artifact of the sampling techniques and effort used by different collectors in different forest types as well as of the combination of different environmental characteristics influencing fructification patterns in the field and in laboratory conditions. However, is an observation that might indicate that there are genera more specialized for colder, more temperate-like environments such as the oak-dominated high-elevation forests of Costa Rica.

In any case, the high number of species found in high-elevations suggests that these areas are more diverse than previously thought. Interestingly, the difference observed with respect to low-elevation areas seems to be associated with the abundance of records and not with species richness. For instance, even the number of singletons found at the different elevational floors increases with elevation. These observations may indicate that the dynamics of myxomycete communities in the different elevations depend upon characteristics of the ecosystems present. In a recent study, Stephenson *et al*. (2007) suggested that some of the changes in species composition among myxomycete assemblages in different areas seem to be associated with a series of micro- and macroenvironmental characteristics of the areas in question. Recent observations on the species assemblages found in a series of high-elevation areas in the northern section of the Neotropics suggest the same (Rojas *et al*. in prep.).

In summary, myxomycetes are more common and diverse in Costa Rica than previously realized. The high diversity of species reported herein certainly suggests that patterns of species distribution should be analyzed in the context of research carried out in other areas of the world. Even in well studied areas, patterns of species distribution need to be reconsidered in the context of forest structure (e.g. Keller *et al*. 2004; Schnittler *et al*. 2006). In most tropical countries, the prerequisite baseline data are not yet available to encourage researchers to conduct such type of studies. For that reason, basic information about myxomycete assemblages from different parts of the world is still required.

ACKNOWLEDGEMENTS

We would like to express our gratitude to the authorities of the Costa Rican Ministry of Environment, Energy and Telecommunications (MINAET) for facilitating the research permits necessary for this study; to Randall Valverde, Mitzi Campos, Julieta Carranza and Armando Ruiz-Boyer for their help during the data processing and collection examination; to the National System of Conservation Areas, the Organization for Tropical Studies and the University of Arkansas for logistic help and to the National Science Foundation for providing the majority of the funding for this project (to SLS).

LITERATURE CITED

Adl, S., A. Simpson, M. Famer, R. Andersen, R. Anderson, J. Barta, S. Bowser, G. Brugerolle, R. Fensome, S. Fredericq, T. James, S. Karpov, P. Kugrens, J. Krug, C. Lane, L. Lewis, J. Lodge, D. Lynn, D. Mann, R. McCourt, L. Mendoza, Ø. Moetru, S. Mozley-Standridge, T. Nerad, C. Shearer, A. Smirnov, F. Spiegel, & M. Taylor. 2005. The New Higher Level Classification of Eukaryotes with Emphasis on the Taxonomy of Protists. Journal of Eukaryotic Microbiology 52(5): 399-451.

Alexopoulos, C. J. & J. A. Sáenz. 1975. The myxomycetes of Costa Rica. Mycotaxon 2: 223-271.

Cannon, P. & B. Sutton. 2004. Microfungi on wood and plant debris. *In*: Mueller, G., Bills, G. & M. Foster (eds.). Biodiversity of fungi: Inventory and monitoring methods. Elsevier Academic Press, Burlington, MA. pp. 217-239.

Chao, A. & T. J. Shen. 2003. SPADE (Species Prediction And Diversity Estimation), February 2009 Version. [online]. <http://chao.stat.nthu.edu.tw> [24 September 2009].

Chao, A., P. C. Li, S. Agatha & W. Foissner. 2006. A statistical approach to estimate soil ciliate diversity and distribution based on data from five continents. Oikos 114: 479-493.

Clark, J. D. 2004. Reproductive systems and taxonomy in the myxomycetes. Systematics and Geography of Plants 74: 209-216.

Estrada-Torres, A., D. Wrigley de Basanta, E. Conde & C. Lado. 2009. Myxomycetes associated with dryland ecosystems of the Tehuacán-Cuicatlán Valley Biosphere Reserve, Mexico. Fungal Diversity 36: 17-56.

Farr, M. 1976. Flora Neotropica Monograph No. 16 (Myxomycetes). New York Botanical Garden, New York. 304 p.

Fiore-Donno, A. M., S. Nikolaev, M. Nelson, J. Pawlowski, T. Cavalier-Smith, & S. Baldauf. 2010. Deep Phylogeny and Evolution of Slime Moulds (Mycetozoa). Protist 161(1): 55-70.

Hammer, Ø., D. A. T. Harper & P. D. Ryan. 2001. PAST: Paleontological statistics software package for education and data analysis. Palaeontologia Electronica 4(1): 9 p.

Hennings, P. C. 1902. Fungi Costaricenses I a cl. Dr. H. Pittier mis. Hedwigia Beiblatt 41: 101-105.

Holdridge, L. R., W. C. Grenke, W. H. Hatheway, T. Liang & J. A. Tosi. 1971. Forest Environments in Tropical Life Zones: a Pilot Study. Pergamon Press, Oxford. 747 p.

Keller, H. W., M. Skrabal, U. Eliasson & T. Gaither. 2004. Tree canopy biodiversity in the Great Smoky Mountains National Park: ecological and developmental observations of a new myxomycete species of *Diachea*. Mycologia 96(3): 537-547.

Lado, C. 2001. Nomenmyx. A nomenclatural taxabase of myxomycetes. Cuadernos de Trabajo de Flora Micológica Ibérica 16: 1-221.

Lado, C. 2005-2010. An on-line nomenclatural information system of Eumycetozoa. [online]. <http://www.eumycetozoa.com> [11 September 2009].

Lado, C. & D. Wrigley de Basanta. 2008. A review of Neotropical Myxomycetes (1828-2008). Anales del Real Jardín Botánico de Madrid 65(2): 211-254.

Magurran, A. E. 2004. Measuring Biological Diversity. Blackwell Publishing, Malden, Massachussets. 256 p.

Martin, G. & C. J. Alexopoulos. 1969. The Myxomycetes. University of Iowa Press, Iowa. 561 p.

Moore, D. & S. L. Stephenson. 2003. Microhabitat distribution of protostelids in a Tropical Wet Forest in Costa Rica. Mycologia 95(1): 11-18.

Moreno, G., C. Rojas, S. L. Stephenson & H. Singer. 2009. A new species of *Lamproderma* (Myxomycetes) from Costa Rica. Mycological Progress 8(3): 215-219.

Morin, P. 1999. Community Ecology. Blackwell Science Inc. Malden, Massachusetts, 424 p.

Novozhilov, Y., M. Schnittler, I. Zemlianskaia & K. Fefelov. 2000. Biodiversity of plasmodial slime moulds (Myxogastria): measurement and interpretation. Protistology 1(4): 161-178.

Pawlowski, J. & F. Burki. 2009. Untangling the Phylogeny of Amoeboid Protists. Journal of Eukaryotic Microbiology 56: 16-25.

Raaijmakers, J. G. W. 1987. Statistical analysis of the Michaelis-Menten equation. Biometrics 43: 793-803.

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

Rojas, C. & S. L. Stephenson. 2008. Myxomycete ecology along an elevation gradient on Cocos Island, Costa Rica. Fungal Diversity 29: 117-127.

Rojas, C., M. Schnittler, D. Biffi & S. L. Stephenson. 2008. Microhabitat and niche separation in species of *Ceratiomyxa*. Mycologia 100: 843-850.

Rojas, C., R. Valverde, S. L. Stephenson & M. J. Vargas. 2009. Ecological patterns of Costa Rican myxomycetes. Fungal Ecology doi 10.1016/j.funeco.2009.08.002

Schnittler, M. 2001. Foliicolous liverworts as a microhabitat for Neotropical Myxomycetes. Nova Hedwigia 72: 259-270.

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

Schnittler, M. & S. L. Stephenson. 2002. Inflorescences of Neotropical herbs as a newly discovered microhabitat for myxomycetes. Mycologia 94: 6-20.

Schnittler, M. & J. Tesmer. 2008: A habitat colonisation model for spore-dispersed organisms – does it work with eumycetozoans? Mycological Research 112: 697-707.

Schnittler, M., C. Lado & S. L. Stephenson. 2002. Rapid Biodiversity Assessment of a tropical myxomycete assemblage – Maquipucuna Cloud Forest Reserve, Ecuador. Fungal Diversity 9: 135-167.

Schnittler, M., M. Unterseher & J. Tesmer. 2006. Species richness and ecological characterization of myxomycetes and myxomycete-like organisms in the canopy of a temperate deciduous forest. Mycologia 98(2): 223-232.

Stephenson, S. & H. Stempen. 1994. Myxomycetes: a handbook of slime molds. Timber Press, Oregon. 200 p.

Stephenson, S. L., I. Kalyanasundaram & T. 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., M. Schnittler & Y. Novozhilov. 2007. Myxomycete diversity and distribution from the fossil record to the present. Biodiversity and Conservation 17(2): 285-301.

Stephenson, S. L., M. Schnittler, C. Lado, A. Estrada-Torres, D. Wrigley de Basanta, J. Landolt, Y. Novozhilov, J. Clark, D. Moore & F. Spiegel. 2004. Studies of neotropical mycetozoans. Systematics and Geography of Plants 74: 87-108.

Welden, A. 1954. Some myxomycetes from Panama and Costa Rica. Mycologia 46: 93-99.

Wrigley de Basanta, D., S. L. Stephenson, C. Lado, A. Estrada-Torres & A. M. Nieves-Rivera. 2008. Lianas as a microhabitat for myxomycetes in tropical forests. Fungal Diversity 28: 109-125.

List of Costa Rican Myxomycetes

Arcyria afroalpina Rammeloo 1981: LTRF; GL, AL; 5, 8, 9; UARK. Occasional. Also reported from Mexico, Cuba, Puerto Rico and Ecuador.

cinerea (Bull.) Pers. 1801: LTRF; DBW, GL; 2, 3, 4, 5, 7, 8, 10; USJ, CR, UARK, M. Abundant. Present in almost all ecosystems, ubiquitous in the Neotropics.

denudata (L.) Wettst. 1886: PWFTp, PWFTL; DBW, GL; 2, 3, 4, 7, 10; USJ, UARK, M. Abundant. Present in almost all ecosystems, ubiquitous in the Neotropics.

incarnata (Pers. ex J.F.Gmel.) Pers. 1796: PMFTL, PMF; DBW; 3, 4, 10; USJ, UARK. Rare. Ubiquitous in the Neotropics.

insignis Kalchbr. & Cooke, in Kalchbr. 1882: LMF, LTDF, PWF, PMF, LMWF; DBW, GL, AL, LP, FI; 3, 4, 10; USJ, BPI, UARK, M. Abundant. Widespread in the Neotropics (see 10).

magna Rex 1893: PMF; DBW; 3, 4, 10; USJ, BPI, UARK. Rare. Also reported from Mexico, Panama, Cuba, Dominica and Brazil.

minuta Buchet 1927: MRF, LWF; DBW; 8, 10; UARK, M. Rare. Known only from Cocos Island and Villa Mills. Also reported from Mexico, Panama, Brazil and Argentina.

obvelata (Oeder) Onsberg 1979 = *Arcyria nutans* (Bull.) Grev.1824: PMFTL; DBW; 4, 10; UARK. Rare. Widespread in the Neotropics (see 10).

? *oerstedii* Rostaf. 1875: Possibly found in LMF; DBW; 4; no vouchers known (see comments of this species in 4). Rare. Also reported from Mexico, Panama, Cuba, Venezuela, Brazil, Paraguay and Argentina.

* *pomiformis* (Leers) Rostaf. 1875: PMF; DBW; first published report for Costa Rica; UARK, M. Rare. Also reported from Mexico, Panama, Jamaica, Puerto Rico, Colombia, Venezuela, Brazil, Ecuador and Argentina.

Badhamia cinerascens G.W. Martin 1932: LMF; DBW; 3, 10; no vouchers known. Rare. Also reported from Colombia and Argentina.

* *utricularis* (Bull.) Berk. 1853: MRF; DBW; first published report for Costa Rica; M. Rare. Also reported from Mexico and Bolivia.

* *Barbeyella minutissima* Meyl. 1914: MRF; DBW; first published report for Costa Rica; UARK. Rare. Also reported from Mexico.

Ceratiomyxa fruticulosa (O.F. Müll.) T. Macbr. 1899: PWFTL, PMFTL; DBW; 2, 3, 4, 5, 7, 9, 10; USJ, BPI, UARK, M. Abundant. See Rojas *et al*. (2008) for a detailed discussion of the ecological requirements of the species of *Ceratiomyxa*. Fiore-Donno *et al*. (2010) discussed the phylogenetic affinity of this genus. Ubiquitous in the Neotropics.

morchella A.L.Welden 1954: PWFTL, PMFTL, PWF; DBW; 3, 4, 9, 10; USJ, BPI, UARK, M. Occasional. This seems to be a tropical lowland species. Also reported from Mexico, Honduras, Panama, Ecuador, Peru, Jamaica, Puerto Rico, Venezuela and Suriname.

sphaerosperma Boedijn 1927: PWFTL; DBW, GL; 2, 3, 4, 9, 10; USJ and UARK. Rare. Widespread in the Neotropics (see 10).

Clastoderma debaryanum A. Blytt 1880: LWF, LDF, PWF, MRF; DBD, TW, AL; 3, 4, 5, 7, 8, 10; USJ, BPI, UARK, M. Occasional. Widespread in the Neotropics (see 10).

pachypus Nann.-Bremek. 1968: LDF, PRF; AL; 8, 10; UARK, M. Rare. Also reported from Mexico and Brazil.

Collaria arcyrionema (Rostaf.) Nann.-Bremek. ex Lado 1991 ☰ *Lamproderma arcyrionema* Rostaf. 1874: LMF, LWF, PWF; GL, AL; 3, 4, 5, 7, 10; USJ, BPI, UARK, M. Common. Widespread in the Neotropics (see 10).

lurida (Lister) Nann.-Bremek. 1975 ☰ *Comatricha lurida* Lister 1894: LMF, LWF, PWF; GL; 8, 10; UARK. Occasional. Also reported from Mexico, Cuba, Puerto Rico and Colombia.

rubens (Lister) Nann.-Bremek. 1975 ☰ *Comatricha rubens* Lister 1894: LMF, PRF; GL; 5, 10; UARK. Rare. Also reported from Mexico, Ecuador and Argentina.

Comatricha elegans (Racib.) G. Lister 1909: LMWF, LMF; DBW, AL; 3, 4, 8, 10; BPI, UARK. Rare. Also reported from Mexico, Cuba, Jamaica, Haiti, Puerto Rico, Colombia, Ecuador, Venezuela, Trinidad, Brazil, Chile and Argentina.

laxa Rostaf. 1874: LMF, PRF; GL, AL; 8, 10; UARK. Rare. Also reported from Mexico, Guatemala, Panama, Cuba, Puerto Rico, Venezuela, Brazil and Chile.

** *laxifila* R.K.Chopra & T.N.Lakh., in Chopra, Nannenga-Bremekamp & Lakhanpal 1992: LDF; DBW; first published report for Costa Rica; UARK. Rare. Not yet reported for the Neotropical region (see 10).

nigra (Pers. ex J.F. Gmel.) J.Schröt. 1885: LWF, PRF, MRF; DBW, TW, GL, AL; 8, 10; UARK, M. Occasional. Widespread in the Neotropics (see 10).

pulchella (C. Bab.) Rostaf. 1876: LWF, PRF, MRF; DBW, AL, LC; 7, 8, 10; USJ, UARK, M. Occasional. Also reported from Mexico, Panama, Puerto Rico, Venezuela, Brazil, Ecuador, Bolivia, Uruguay and Argentina.

tenerrima (M.A. Curtis) G. Lister 1919: LWF, PRF, MRF; TW, GL, AL, LC, FI; 3, 4, 7, 8, 10; USJ, BPI, UARK. Occasional. Also reported from Mexico, Belize, Cuba, Jamaica, Puerto Rico, Venezuela, Brazil, Ecuador, Peru and Argentina.

Craterium aureum Morgan 1893: LWF, PMF; AL, LP; 8, 10; USJ, UARK. Rare. Also reported from Mexico, Jamaica, Puerto Rico, Dominican Republic, Colombia, Venezuela, Brazil, Ecuador, Peru and Argentina.

concinnum Rex 1893: MRF, SRP; GL, AL, FI; 5, 10; UARK, M. Occasional. Also reported from Cuba, Jamaica, Colombia and Ecuador.

leucocephalum (Pers. ex J.F. Gmel.) Ditmar 1813: LMF, PMF, LMMF; GL; 3, 4, 5, 10; USJ, BPI, UARK, M. Occasional. Widespread in the Neotropics (see 10).

* *paraguayense* (Speg.) G. Lister, in Lister 1911: PWF, LMFTP, LMWF; GL, LP, first published report for Costa Rica; USJ, UARK, M. Rare. Also reported from Panama, Colombia, Venezuela, French Guiana, Brazil, Ecuador, Paraguay and Argentina.

* *Cribraria aurantiaca* Schrad. 1797: MRF; GL; first published report for Costa Rica; M. Rare. Also reported from Mexico, Panama, Venezuela, Jamaica, Brazil, Chile and Argentina.

cancellata (Batsch) Nann.-Bremek. 1975 ☰ *Dictydium cancellatum* (Batsch) T.Macbr. 1899: PWFTL, LDF, PRF, PMF; DBW; 2, 3, 4, 10; USJ, BPI, UARK, M. Occasional. Ubiquitous in the Neotropics (see 10).

* *confusa* Nann.-Bremek. & Y.Yamam. 1983: LDF; DBW; first published report for Costa

Rica; M. Rare. Also reported from Mexico, Belize and Ecuador.

* *costata* Dhillon & Nann.-Bremek. 1978: MRF; DBW, GL, DU; first published report for Costa Rica; M. Rare. Also reported from French Guiana.

intricata Schrad. 1797: PMFTL, MRF; DBW; 3, 4, 7, 8, 10; USJ, BPI, UARK, M. Common. Widespread in the Neotropics (see 10).

languescens Rex 1891: PMFTL, LMF, LDF, MRFTLW; DBW; 3, 4, 10; USJ, BPI, UARK, M. Occasional. Widespread in the Neotropics (see 10).

* *macrocarpa* Schrad. 1797: MRF; DBW; first published report for Costa Rica; M. Rare. Also reported from Mexico, Colombia and Chile.

microcarpa (Schrad.) Pers. 1801: LWF, PRF, PMF; DBW, GL, AL; 3, 4, 5, 8, 10; USJ, UARK, M. Occasional. Widespread in the Neotropics (see 10).

minutissima Schwein. 1832: LMFTP; DBW; 3, 10; no vouchers known. Rare. Also reported from Mexico, Jamaica, Guadeloupe, Dominica, Trinidad, Brazil and Uruguay.

mirabilis (Rostaf.) Massee 1892: MRF, DBW; 7, 10; USJ, UARK. Occasional. Also reported from Mexico, Brazil and Chile.

piriformis Schrad. 1797: MRF; DBW; 7; 10; USJ, UARK. Occasional. Also reported from Mexico, Guatemala, Panama, Brazil and Chile.

* *purpurea* Schrad. 1797: LMRF; DBW; first published report for Costa Rica; UARK. Rare. Also reported from Mexico and Venezuela.

splendens (Schrad.) Pers. 1801: PWFTL, PMF, LMWF; DBW; 3, 4, 10; USJ. Rare. Also reported from Mexico, Jamaica, Virgin Islands, Venezuela, Brazil and Chile.

tenella Schrad. 1797: PWFTL, PMF, LMRF; DBW; 3, 4, 10; USJ, UARK, M. Occasional. Widespread in the Neotropics (see 10).

violacea Rex 1891: LDF, LMF; DBW, GL; 3, 5, 8, 10; USJ, UARK, M. Abundant. Widespread in the Neotropics (see 10).

vulgaris Schrad. 1797: MRF; DBA, LC; 4, 5, 7, 10; USJ, BPI, UARK. Occasional. Also reported from Argentina.

Diachea bulbillosa (Berk. & Broome) Lister 1898: LDF, LMRF; GL, LP; 3, 4, 10; USJ, UARK, M. Occasional. Also reported from Panama, Cuba, Jamaica, Puerto Rico, Dominica, Grenada, Colombia, Venezuela and Ecuador.

leucopodia (Bull.) Rostaf. 1874: LWF, LWFTP, LMMF; GL; 1, 3, 4, 5, 8, 10; USJ, BPI, UARK, M. Occasional. Cosmopolitan.

Diacheopsis sp. Meyl. 1930: MRF; DBW; 7; UARK. Rare. In the Neotropics, the genus is reported only from Mexico and Costa Rica. The material from Costa Rica was too limited to permit an identification to species.

Dictydiaethalium plumbeum (Schumach.) Rostaf. 1894: PWFTL, MRF; LP; 3, 4, 10; USJ. Rare. Also reported from Mexico, Nicaragua, Panama, Dominican Republic, Puerto Rico, Colombia, Venezuela, Brazil, Chile and Argentina.

Diderma chondrioderma (de Bary & Rostaf.) G. Lister 1925: PWF, MRF; DBW, LC; 2, 3, 7, 10; USJ, BPI, UARK. Rare. Also reported from Mexico, Belize, Jamaica, Puerto Rico, Dominica, Brazil and Ecuador.

corrugatum T.E. Brooks & H.W. Keller 1977: LDF, PMFTL; DBW, LI; 5, 10; UARK, M. Rare. Also reported from Cuba, Brazil and Ecuador.

deplanatum Fr. 1829: LDF; DBW; 5, 10; UARK, M. Rare. Also reported from Mexico and Brazil.

effusum (Schwein.) Morgan 1894: LMF, LDF, PMF, LMRF; TW, GL, LC, FI; 3, 4, 5, 8, 10; USJ, BPI, UARK, M. Common. Widespread in the Neotropics (see 10).

* *globosum* Pers. 1794: PWFTp; DBW; first published report for Costa Rica; M. Rare. Also reported from Venezuela, Ecuador, Peru and Argentina.

hemisphaericum (Bull.) Hornem. 1829: LWF, LDF, PWF, LMRF; GL, AL; 3, 4, 5, 8, 10; USJ, BPI, UARK, M. Abundant. Widespread in the Neotropics (see 10).

** *indicum* K.S.Thind & H.S.Sehgal 1964: PMF; LP; first published report for Costa Rica; USJ. Rare. Apparently not yet reported for the Neotropical region (see 10).

* *montanum* (Meyl.) Meyl. 1913: MRF; GL; first published report for Costa Rica; M. Rare. Also reported from Venezuela.

niveum (Rostaf.) T. Macbr. 1899: MRF; TW; 4, 10;

no vouchers reported (see information on this species in 4). Rare. Also reported from Mexico, Colombia, Chile and Argentina.

* *ochraceum* Hoffm. 1795: MRF; LC; first published report for Costa Rica; UARK. Rare. Also reported from Mexico.

rugosum (Rex) T. Macbr. 1899: LWF; GL; first published report for Costa Rica; UARK. Rare. Also reported from Mexico, Panama, Jamaica, Antigua and Trinidad.

* *saundersii* (Berk. & Broome ex Massee) Lado 2001: PWFTL; GL; first published report for Costa Rica; UARK. Rare. Also reported from Mexico and Ecuador.

sauteri (Rostaf.) T. Macbr. 1899: PMF; GL; 3, 10; UARK. Rare. Also reported from Mexico and Venezuela.

* *subdictyospermum* (Rostaf.) G. Lister 1911: PWF; GL; first published report for Costa Rica; UARK. Rare. Also reported from Mexico and Venezuela.

* *subincarnatum* Kowalski 1967: PWFTL; GL; first published report for Costa Rica; BPI. Rare. Also reported from Mexico and Chile.

testaceum (Schrad.) Pers. 1801: LWF, PRF, MRF; GL, AL, FI; 3, 4, 5, 10; USJ, BPI, UARK, M. Rare. Also reported from Mexico, Cuba, Jamaica, Dominican Republic, Guadeloupe, Brazil and Chile.

* *Didymium anellus* Morgan 1894: LMF, PWF; AL; first published report for Costa Rica; UARK. Rare. Also reported from Mexico, Jamaica, Puerto Rico, Trinidad, Colombia, Brazil, Ecuador, Chile and Argentina.

* *bahiense* Gottsb. 1968: PWF, LMRF, MRF; GL, AL; first published report for Costa Rica; UARK, M. Rare. Also reported from Mexico, Colombia, Venezuela, Ecuador and Brazil.

clavus (Alb. & Schwein.) Rabenh. 1844: PWF, LMRF, MRF; GL, AL, FI; 2, 3, 4, 5, 10. Common. Vouchers deposited in USJ, BPI, UARK, M. Widespread in the Neotropics (see 10.)

* *comatum* (Lister) Nann.-Bremek. 1966: PWF, LMRF; GL; first published report for Costa Rica; UARK, M. Rare. Also reported from the Antillean Windward Islands.

crustaceum Fr. 1829: PMF; DBW; 3, 4, 10; USJ. Rare. Also reported from Mexico, Cuba, Dominica and Bolivia.

difforme (Pers.) Gray 1821: LMF, LWFTP, PRF, SRP; GL, AL; 3, 4, 5, 10; USJ, BPI, UARK, M. Occasional. Widespread in the Neotropics (see 10).

dubium Rostaf. 1874: LMWF, MRF; DBA, FR, GL; 7, 10; USJ, M. Occasional. Also reported from Mexico, Colombia, Venezuela and Argentina.

* *floccosum* G.W. Martin, K.S. Thind & Rehill 1959: LDF; GL; first published report for Costa Rica; UARK. Rare. Also reported from Venezuela, Ecuador and Argentina.

iridis (Ditmar) Fr. 1829: LWF, LMF, PWF, PWFTp, LMRF; GL, AL, LC, FR, FI; 3, 4, 5, 8, 10; USJ, BPI, UARK, M. Abundant. Probably ubiquitous in the Neotropics.

* *laxifilum* G. Lister & J. Ross 1945: PMF, substrate not reported; first published report for Costa Rica; USJ. Rare. Also reported from Mexico.

* *listeri* Massee 1892: PWF, LMRF; GL; first published report for Costa Rica; UARK. Occasional. Also reported from from Mexico and Ecuador.

minus (Lister) Morgan 1894: LWF, LDF, PMF, SRP; DBW, GL, AL, LC; 3, 4, 8, 10; USJ, BPI, UARK, M. Occasional. Also reported from Mexico, Jamaica, Antigua, Dominica, Ecuador, Colombia, Brazil, Uruguay, Chile and Argentina.

nigripes (Link) Fr. 1829: LWF, LDF, PMF, LMRF, MRF, SRP; DBW, GL, AL, LP, FI; 3, 4, 10; USJ, BPI, UARK, M. Common. Widespread in the Neotropics (see 10).

ochroideum G.Lister 1931: LMF, LDF, PRF, LMRF; GL, AL, FR; 5, 10; UARK, M. Common. Also reported from Mexico, Brazil and Ecuador.

ovoideum Nann.-Bremek. 1958: LDF, PWF, GL; 5; no vouchers known (see information on this species in 5). Rare. Also reported from Mexico.

squamulosum (Alb. & Schwein.) Fr. 1818: LWF, PWF, LMRF; GL, AL, LC, FI, DBW; 2, 3, 4, 5, 7, 8, 10; USJ, BPI, UARK, M. Abundant. Ubiquitous in the Neotropics.

* *sturgisii* Hagelst. 1937: LMF; GL; first published report for Costa Rica; M. Rare. Also reported from Mexico.

* ? *Echinostelium apitectum* K.D. Whitney 1980: LDF; DBW; first published report for Costa Rica; no vouchers known, but the species seems

to have been observed in the country. Rare. Also reported from Mexico and Ecuador.

bisporum (L.S. Olive & Stoian.) K.D. Whitney & L.S. Olive 1982: LWF; GL; 6, 10; no vouchers known. Rare. Also reported from Cuba.

minutum de Bary 1874: LDF, LMF, PWF, PRF; DBW, AL; 5, 8, 10; UARK, M. Occasional. Widespread in the Neotropics (see 10).

* *Enerthenema papillatum* (Pers.) Rostaf. 1876: MRF; TW; first published report for Costa Rica; UARK. Rare. Also reported from Mexico, Brazil, Ecuador, Chile and Argentina.

Fuligo cinerea (Schwein.) Morgan 1896: LDF; DBW; 5, 10; no vouchers known (see information on this species in 5). Rare. Also reported from Mexico, Cuba, Jamaica, Dominica, Barbados, Brazil and Argentina.

* *intermedia* T.Macbr. 1922: PMF; DBW; first published report for Costa Rica; BPI. Rare. Also reported from Mexico.

megaspora Sturgis 1913: LMFTP, PWFTL; LP; 3, 4, 10; USJ, BPI, UARK. Rare. Also reported from Mexico, Guatemala, Brazil and Argentina.

septica (L.) F.H. Wigg. 1780: PMF, PWF, LMF; GL, DBW; 2, 3, 4, 10; USJ, CR, BPI, UARK, M. Occasional. Widespread in the Neotropics.

Hemitrichia calyculata (Speg.) M.L.Farr 1974 = *Hemiarcyria stipitata* Massee 1889 = *Arcyria stipitata*(Massee) Massee 1892: LMF, PWFTL, PWF, MRF; DBW, GL, LP; 2, 3, 4, 7, 10; USJ, BPI, UARK, M. Abundant. Probably ubiquitous in the Neotropics (see 10).

leiocarpa (Cooke) Lister 1894 ☰ *Arcyria leiocarpa* (Cooke) Massee 1892: LWF, MRF; DBW, TW; 3, 7, 10; USJ and M. Rare. Also reported from Mexico, Belize, Panama, Cuba, Colombia, Grenada and Brazil.

minor G.Lister 1911 = *Perichaena minor* (G.Lister) Hagelst. 1943: LDF, LMF, PWF, PRF, PMF, LMRF; DBW, GL, AL; 5, 8, 10; UARK. Common. Also reported from Mexico, Belize, Panama, Dominica, Brazil and Chile.

pardina (Minakata) Ing 1999 ☰ *Perichaena minor* var. *pardina* (Minakata) Hagelst.1943: LMF, PMF; GL, AL, LP, 10; UARK, M. Rare. Also reported from Mexico, Cuba, Puerto Rico, Brazil and Ecuador.

serpula (Scop.) Rostaf. ex Lister 1894: LDF, MRF; DBW, GL, LP; 3, 4, 7, 8, 10; USJ, BPI, UARK, M. Common. Widespread in the Neotropics (see 10).

* *Lamproderma arcyrioides* (Sommerf.) Rostaf. 1874: MRF; GL; first published report for Costa Rica; BPI, M. Rare. Also reported from Mexico, Jamaica, Dominican Republic, Puerto Rico, Brazil and Argentina.

columbinum (Pers.) Rostaf. 1873: MRF; DBW, LC; 7, 10; USJ, UARK. Occasional. Also reported from Mexico.

** *cribrarioides* (Fr.) R.E. Fr. 1911: MRF; DBW; 7, 10; UARK. Rare. Not reported from other country in the Neotropics.

echinulatum (Berk.) Rostaf. 1876: MRF; DBW, LC; 7, 10; USJ. Rare. Also reported from Mexico.

** *magniretispora* G. Moreno, C. Rojas, S.L. Stephenson & H. Singer 2009: MRF; DBW; 11; UARK. Rare. Not reported from other country in the Neotropics.

muscorum (Lév.) Hagelst. 1935: LMRF; DBW; 3, 10; BPI. Rare. Also reported from Mexico, Colombia, Venezuela and Brazil.

** *sauteri* Rostaf. 1874: MRF; DBW; 7, 10; UARK. Rare. Not reported from other country in the Neotropics.

scintillans (Berk. & Broome) Morgan 1894: LMF, LDF, PWF, LMRF; GL, AL, LC; 3, 4, 5, 8, 10; USJ, BPI, UARK, M. Abundant. Also reported from Mexico, Panama, Cuba, Jamaica, Haiti, Puerto Rico, Antigua, Dominica, Colombia, Venezuela, Brazil, Ecuador and Bolivia.

Leocarpus fragilis (Dicks.) Rostaf. 1874: MRF, SRP; DBW, TW; 7, 10; USJ, UARK and M. Occasional. Also reported from Mexico, Colombia, Brazil, Chile and Argentina.

* *Lepidoderma trevelyanii* (Grev.) Poulain & Mar.Mey. 2002: PWF; DBW; first published report for Costa Rica; UARK. Rare. Also reported from Chile and Argentina.

Licea biforis Morgan 1893: PMF; GL; 5; no vouchers known. Rare. Also reported from Mexico, Belize, Cuba, Jamaica, Colombia, Brazil, Ecuador and Chile.

* *denudescens* H.W.Keller & T.E.Brooks 1977: PWF; DBW; first published report for Costa Rica; M. Rare. Also reported from Mexico, Belize and Brazil.

* *erecta* K.S. Thind & Dhillon 1967: LMRF; DBW; first published report for Costa Rica; UARK. Rare. Also reported from Belize, Cuba and Brazil.

* *minima* Fr. 1829: MRF, SRP; DBW, GL, FI; first published report for Costa Rica; UARK, M. Rare. Also reported from Mexico, Panama and Uruguay.

operculata (Wingate) G.W. Martin 1942: LDF, LMF, PWF; DBW, AL; 5, 10; UARK. Rare. Also reported from Mexico, Panama, Puerto Rico, Dominica, Venezuela, Brazil, Ecuador, Peru and Uruguay.

* *pedicellata* (H.C.Gilbert) H.C.Gilbert 1942: LDF; DBW; first published report for Costa Rica, UARK. Rare. Also reported from Mexico, Panama, Puerto Rico, Grenada, Brazil and Ecuador.

perexigua T.E. Brooks & H.W. Keller 1977: LDF; DBW; 5, 10; UARK. Rare. Also reported from Mexico, Belize and Ecuador.

* *pusilla* Schrad. 1797: SRP; DBW; first published report for Costa Rica; UARK. Rare. Also reported from Mexico, Panama and Jamaica.

** *testudinacea* Nann.-Bremek. 1965: MRF, SRP; DBW; first published report for Costa Rica; UARK. Rare. Not reported from other country in the Neotropics.

* *Lycogala conicum* Pers. 1801: PWFTL, PMFTL, PMF; DBW; first published report for Costa Rica; USJ, UARK. Rare. Also reported from Mexico, Nicaragua, Panama, Cuba, Jamaica, Guadeloupe and Brazil.

epidendrum (L.) Fr. 1829: MRF, LMWF, PWFTL; DBW, GL, LC; 3, 4, 5, 7, 10; USJ, CR, BPI, UARK, M. Abundant. Widespread in the Neotropics (see 10).

exiguum Morgan 1893: PMFTL, LDF, PWF; DBW, GL; 3, 10; USJ, BPI, UARK, M. Occasional. Also reported from Mexico, Panama, Cuba, Jamaica, Puerto Rico, Guadeloupe, Martinique, Dominica, Colombia, Venezuela, Guyana, French Guiana, Brazil and Ecuador.

Macbrideola cornea (G. Lister & Cran) Alexop. 1967: LDF; DBW; 5, 10; UARK. Rare. Also reported from Mexico and Ecuador.

decapillata H.C. Gilbert 1934: lowlands (unknown forest type); DBW; 4, 10; no vouchers known. Rare. Also reported from Mexico and Ecuador.

martini (Alexop. & Beneke) Alexop. 1967: LDF, LMRF, LMWF; DBW, LI, GL; 5, 10; UARK. Occasional. Also reported from Mexico, Belize, Jamaica, Dominica, Brazil and Ecuador.

scintillans H.C. Gilbert 1934: LDF, LMRF; DBW; 5, 10; UARK, M. Occasional. Also reported from Mexico and Belize.

Metatrichia floriformis (Schwein.) Nann.-Bremek. 1985 ☰ *Trichia floriformis* (Schwein.) G. Lister 1919: MRF, LMRF, PMF, PWF, LDF, LMF; DBW, LI, LC, DU; 3, 4, 7, 10; USJ, BPI, UARK, M. Common. Also reported from Mexico, Jamaica, Puerto Rico, Venezuela, Brazil, Ecuador, Chile and Argentina.

vesparia (Batsch) Nann.-Bremek. ex G.W. Martin & Alexop. 1969: LDF, LMF, PWF, PMF; DBW, GL, LP; 3, 4, 5, 10; USJ, BPI, UARK, M. Occasional. Widespread in the Neotropics (see 10).

* *Paradiacheopsis acanthodes* (Alexop.) Nann.-Bremek., in Nannenga-Bremekamp & Yamamoto 1986: LDF; DBW; reported in 5 as *Paradiacheopsis* cf. *acanthodes*; UARK. Rare. Not reported from any other country in the Neotropics.

longipes Hoof & Nann.-Bremek. 1996: PMF, GL; 5, 10, no vouchers known. Rare. Not reported from other country in the Neotropics.

rigida (Brândza) Nann.-Bremek. 1969: MRF; DBW; first published report for Costa Rica, vouchers deposited at UARK. Rare. Also reported from Belize.

Perichaena chrysosperma (Curr.) Lister 1894: LWF, LMF, PMF, LMRF; DBW, TW, GL, AL; 3, 4, 5, 8, 10; USJ, UARK, M. Common. Widespread in the Neotropics (see 10).

corticalis (Batsch) Rostaf. 1875: LDF, LMF; AL; 5, 10; UARK. Rare. Also reported from Mexico, Panama, Cuba, Dominican Republic, Ecuador, Brazil, Chile and Argentina.

depressa Lib. 1837: LMF, LDF, LWF, MRF; DBW, TW, AL; 3, 5, 7, 8, 10; USJ, UARK and M. Abundant. Widespread in the Neotropics (see 10).

* *dictyonema* Rammeloo 1981: LWF, LDF, PWFTL; GL, FI; first published report for Costa Rica; UARK, M. Common. Also reported from Puerto Rico and Ecuador.

* *microspora* Penz. & Lister 1898: LDF; GL; first published report for Costa Rica; UARK, M. Rare. Also reported from Cuba and Brazil.

pedata (Lister & G. Lister) Lister ex E. Jahn 1919: LMF, PRF, SRP; DBW, GL; 5, 8, 10; UARK, M. Occasional. Also reported from Mexico and Ecuador.

vermicularis (Schwein.) Rostaf. 1876: LMF, LWF, LDF; DBW, GL, AL, LP; 5, 10; USJ, UARK, M. Abundant. Also reported from Mexico, Panama, Cuba, Brazil, Brazil, Ecuador, Peru, Bolivia, Chile and Argentina.

Physarella oblonga (Berk. & M.A. Curtis) Morgan 1896: PWFTL, PMF; DBW, GL; 3, 4, 10; USJ, BPI, UARK, M. Common. Widespread in the Neotropics (see 10).

Physarum album (Bull.) Chevall. 1826 = *Physarum nutans* Pers. 1795: PMFTL, LMF, LMMF, MRF; DBW, GL; 3, 4, 10; USJ, BPI, UARK, M. Occasional. Widespread in the Neotropics (see 10).

* *auriscalpium* Cooke 1877 = *Physarum limonium* Nann.-Bremek. 1966: PWFTL; FI; first published report for Costa Rica; UARK. Rare. Also reported from Mexico, Belize, Panama, Puerto Rico, Guadeloupe, Dominica, Venezuela and Brazil.

bitectum G. Lister 1911: PWF, MRF; DBW; 3, 4, 10; USJ, BPI, UARK. Rare. Also reported from Mexico, Jamaica, Puerto Rico, Colombia and Venezuela.

bivalve Pers. 1795: MRF, SRP, LMF; DBW, GL; 3, 4, 10; USJ, BPI, UARK, M. Occasional. Also reported from Mexico, Panama, Cuba, Haiti, Antigua, Colombia, Venezuela, French Guiana, Peru, Ecuador, Brazil, Chile and Argentina.

bogoriense Racib. 1898: LMF, PWF, PMF, LMRF; GL, LP; DBW; 3, 4, 10; USJ, BPI, UARK. Occasional. Widespread in the Neotropics (see 10).

brunneolum (W. Phillips) Massee 1892: MRF; DBW; 7, 10; USJ. Rare. Also reported from Mexico, Colombia and Chile.

cinereum (W. Phillips) Massee 1892: LMF, PWF, MRF, SRP; GL, LP, DBW; 3, 4, 5, 10; USJ, BPI, UARK, M. Occasional. Widespread in the Neotropics (see 10).

citrinum Schumach. 1803: PWFTL, LMF, PWF; LC; 3, 4, 10; USJ and UARK. Rare. Also reported from Mexico, Colombia, Venezuela, Guadeloupe, Chile and Argentina.

compressum Alb. & Schwein. 1805: LWF, LMF, PWF; FI, GL, AL; 3, 4, 5, 8, 10; USJ, CR, BPI, UARK, M. Abundant. Widespread in the Neotropics.

contextum (Pers.) Pers. 1801: MRF; LC; 7, 10; USJ. Rare. Also reported from Mexico, Nicaragua and Argentina.

crateriforme Petch 1909: LDF; DBW; 5, 10; UARK. Rare. Also reported from Mexico, Belize, Cuba, Puerto Rico, Antigua, Saint Lucia, Brazil and Ecuador.

decipiens M.A.Curtis 1848: LMF, PMF; DBW, LP; 2, 3, 10; USJ, BPI. Rare. Also reported from Mexico, Brazil, Peru and Bolivia.

dictyosporum G.W. Martin 1962: LDF; GL; 3, 4; BPI. Rare. Also reported from Mexico and Colombia.

didermoides (Pers.) Rostaf. 1874: LWF, LMF; FI, GL; 2, 3, 4, 5, 10; USJ, BPI, UARK, M. Abundant. Widespread in the Neotropics (see 10).

* *echinosporum* Lister 1899: LMF, MRF; TW; first published report for Costa Rica; USJ. Rare. Also reported from Panama, Jamaica, Antigua, Dominica, Brazil, Ecuador, Uruguay and Chile.

* *flavicomum* Berk. 1845: LDF, PWF, LMMF; DBW, GL; first published report for Costa Rica; BPI, UARK, M. Occasional. Also reported from Mexico, Belize, Antigua, Trinidad, Colombia, Brazil and Chile.

flavidum (Peck) Peck 1879: MRF; LC; 3, 4, 10; BPI. Rare. Not reported from any other country in the Neotropics.

globuliferum (Bull.) Pers. 1801: LMF, LDF, PMF, MRF; DBW, GL; 3, 4, 5, 10; USJ, BPI, UARK, M. Occasional. Widespread in the Neotropics (see 10).

* *gyrosum* Rostaf. 1874: LDF, PMFTL; LP; first published report for Costa Rica; USJ, UARK. Rare. Also reported from Mexico, Colombia, Brazil and Uruguay.

javanicum Racib. 1898: LWF, LMF, LMRF; DBW, GL, AL; 3, 4, 8, 10; BPI, UARK, M. Rare. Also reported from Mexico, Cuba, Jamaica, Puerto Rico, Colombia, Venezuela, Trinidad, French Guiana, Brazil and Ecuador.

* *leucophaeum* Fr. 1818: PWFTL; GL; first published report for Costa Rica; BPI, UARK. Rare. Also reported from Mexico, Cuba, Jamaica, Dominican Republic, Antigua, Guadeloupe, Dominica, Ecuador, Brazil, Chile and Argentina.

leucopus Link 1809: PMF, MRF; DBW; 3, 7, 10; USJ, BPI. Rare. Also reported from Mexico, Guatemala, Panama, Jamaica, Colombia, Brazil, Paraguay and Argentina.

melleum (Berk. & Broome) Massee 1892: LWF, LMF; GL, LP, DBW; 3, 4, 5, 7, 8, 10; USJ, BPI, UARK, M. Common. Widespread in the Neotropics.

murinum Lister 1894: LWF; DBW; 3, 4, 10; BPI. Rare. Also reported from Mexico.

* *mutabile* (Rostaf.) G. Lister 1911: PMF; DBW; first published report for Costa Rica; USJ. Rare. Also reported from Mexico, Venezuela, Brazil and Argentina.

nicaraguense T. Macbr. 1893: LMF, PMF; LP; 3, 4, 10; USJ, BPI. Rare. Also reported from Mexico, Belize, Nicaragua, Jamaica, Haiti, Puerto Rico, Trinidad and Brazil.

notabile T. Macbr. 1922: LWF, LMF, PWF, LMMF; FI, GL, AL; 3, 4, 5, 10; USJ, BPI, UARK. Rare. Also reported from Mexico, Jamaica, Dominica, Brazil, Bolivia and Argentina.

nucleatum Rex 1891: LMF, PMFTL; DBW, AL; 3, 4, 10; USJ, BPI, UARK, M. Occasional. Also reported from Mexico, Nicaragua, Cuba, Jamaica, Puerto Rico, Dominica, Trinidad, Venezuela, French Guiana, Brazil, Ecuador and Argentina.

* *oblatum* T. Macbr. 1893: LMF, LMRF; FI; first published report for Costa Rica; BPI, UARK. Rare. Also reported from Mexico, Belize, Panama, Jamaica, Dominica, Colombia, Venezuela, Brazil and Ecuador.

* *penetrale* Rex 1891: PWF, PRF, LMRF; DBW, TW; first published report for Costa Rica; UARK, M. Occasional. Also reported from Mexico, Panama, Jamaica, Dominica, Venezuela, French Guiana, Brazil and Chile.

* *pezizoideum* (Jungh.) Pavill. & Lagarde 1903: PWFTL; DBW; first published report for Costa Rica; UARK. Rare. Also reported from Mexico, Cuba, Brazil and Argentina.

polycephalum Schwein. 1822: LWF, PWF, PMF; TW, GL; 3, 4, 10; USJ, BPI, UARK. Occasional. Widespread in the Neotropics (see 10).

pulcherripes Peck 1873: LWF, LMF; GL; 3, 4, 10; USJ, BPI, UARK. Rare. Also reported from Mexico, Panama, Jamaica, Dominica, Trinidad and Venezuela.

pusillum (Berk. & M.A. Curtis) G. Lister 1911: LWF, PWFTL, MRF; GL, AL, DBW, LP, FI; 5, 8, 10; USJ, UARK, M. Abundant. Present in almost all ecosystems, widespread in the Neotropics (see 10).

rigidum (G. Lister) G. Lister 1925: PWF, PMF; DBW; 3, 4, 10; USJ, BPI. Rare. Also reported from Jamaica, Puerto Rico, Trinidad, Brazil, Uruguay and Argentina.

* *robustum* (Lister) Nann.-Bremek. 1973: MRF; DBW; first published report for Costa Rica; UARK. Rare. Also reported from Mexico.

* *roseum* Berk. & Broome 1873: LDF, PMFTL; DBW; reported in 5 as doubtful; USJ and UARK. Rare. Also reported from Mexico, Jamaica, Dominica, Brazil and Paraguay.

serpula Morgan 1896: LMF, LWF; TW, GL, LP; 8, 10; USJ, UARK, M. Common. Also reported from Mexico, Panama, Cuba, Jamaica, Trinidad, Brazil, Ecuador and Argentina.

stellatum (Massee) G.W. Martin 1947: LMF, LDF, PWF, PRF, LMWF, MRF; DBW, TW; 3, 4, 5, 10; USJ, BPI, UARK, M. Occasional. Widespread in the Neotropics (see 10).

* *straminipes* Lister 1898: PMF; GL, LP, reported in 5 as doubtful; UARK. Rare. Also reported from Mexico and Chile.

superbum Hagelst. 1940: LMF, LWF; GL, FI; 8,10; USJ, UARK, M. Common. Also reported from Mexico, Haiti, Puerto Rico, Venezuela, Ecuador and Peru.

tenerum Rex 1890: LMF, PWF, LMWF; DBW; 2, 3, 4, 10; USJ, UARK, M. Occasional. Widespread in the Neotropics (see 10).

viride (Bull.) Pers. 1795: PWFTL, PWF, LMWF; DBW, GL; 1, 3, 4, 10; USJ, BPI, UARK, M. Common. Cosmopolitan.

* *Reticularia jurana* Meyl. 1908: PWFTp; GL; first published report for Costa Rica; M. Rare. Also reported from Mexico, Panama, Dominican Republic, Jamaica, Puerto Rico, Brazil, Ecuador, Uruguay, Chile and Argentina.

* ? *splendens* Morgan 1893: PWF; DBW; first

published report for Costa Rica; no vouchers reported, but the species seems to have been recorded from the country. Rare. Also reported from Mexico, Panama and Chile.

* *Stemonaria gracilis* Nann.-Bremek. & Y. Yamam. 1984: LMF; GL; first published report for Costa Rica; M. Occasional. Also reported from Peru.

longa (Peck) Nann.-Bremek., R. Sharma & Y. Yamam. 1984: LWF, LMF, PWF, PMF; DBW, LP; first published report for Costa Rica; USJ, UARK, M. Occasional. Widespread in the Neotropics (see 10).

axifera (Bull.) T. Macbr. 1899 = *Stemonitis ferruginea* Ehrenb. 1818: PMFTL, LDF, PWF, LMWF, MRF; DBW, GL; 1, 3, 4, 10; USJ, UARK, M. Common. Probably ubiquitous in the Neotropics.

flavogenita E. Jahn 1904: LWF, MRF; TW, AL; 3, 4, 8, 10; BPI, UARK. Rare. Also reported from Mexico, Guatemala, Panama, Cuba, Jamaica, Puerto Rico, Venezuela, Trinidad, Ecuador, Brazil and Argentina.

* *foliicola* Ing 1967: PWFTL; GL; first published report for Costa Rica; UARK. Rare. Also reported from Peru.

fusca Roth 1787: LWF, PMF, MRF; DBW, TW, GL, AL; 3, 4, 5, 7, 8, 10; USJ, BPI, UARK, M. Abundant. Present in almost all ecosystems, widespread in the Neotropics (see 10).

herbatica Peck 1874: LWF, LMF, PWF, PMF; DBW, LP; 3 and 10; BPI, UARK. Rare. Also reported from Mexico, Belize, Guatemala, Bahamas, Cuba, Jamaica, Dominican Republic, Puerto Rico, Antigua, Guadeloupe, Martinique, Dominica, Venezuela, Brazil, Ecuador and Argentina.

* *pallida* Wingate 1899: PRF; DBW; first published report for Costa Rica; UARK. Rare. Also reported from Mexico, Panama, Cuba, Jamaica, Puerto Rico, Trinidad, Venezuela, French Guiana, Brazil, Ecuador and Argentina.

smithii T. Macbr., Bull. Iowa Univ. Lab. Nat. Hist. 2:381 (1893): PMFTL, PMF, MRF; DBW, LC; 7; USJ, UARK. Occasional. Also reported from Mexico, Nicaragua, Panama, Jamaica, Puerto Rico, Antigua, Dominica, Venezuela, Trinidad, Peru, Brazil, Chile and Argentina.

splendens Rostaf. 1874: PMFTL, PWF, PMF, MRF; DBW, GL, AL; 3, 4, 10; USJ, BPI, UARK, M. Common. Widespread in the Neotropics (see 10).

Stemonitopsis aequalis (Peck) Y. Yamam. 1998: LWF; GL; 3, 10; BPI. Rare. Also reported from Panama, Jamaica, Dominica and Brazil.

** *amoena* (Nann.-Bremek.) Nann.-Bremek. 1975: LMF; LP, FI; first published report for Costa Rica; USJ, M. Occasional. Not reported from other country in the Neotropics.

* *gracilis* (G. Lister) Nann.-Bremek. 1975: PRF; DBW; first published report for Costa Rica, UARK. Rare. Also reported from Mexico, Cuba and Brazil.

hyperopta (Meyl.) Nann.-Bremek. 1975: LWF, PMFTL, PRF; TW; 6, 10; USJ, UARK, M. Occasional. Also reported from Mexico, Guatemala, Panama, Jamaica, Puerto Rico, Dominica, Brazil, Chile and Argentina.

subcaespitosa (Peck) Nann.-Bremek. 1975: PWFTL, PMFTL; DBW; 3, 4, 10; USJ, BPI, UARK. Rare. Also reported from Mexico, Dominica, Venezuela, Brazil and Argentina.

typhina (F.H.Wigg.) Nann.-Bremek. 1975 ☰ *Comatricha typhoides* (Bull.) Rostaf. 1894: LMF, PMFTL, PRF, PMF, MRF; DBW, GL; 3, 4, 5, 10; BPI, UARK, M. Common. Widespread in the Neotropics (see 10).

Symphytocarpus herbaticus Ing 1967: PWFTL, PWF, LMFTP; DBW, GL; 3, 4; USJ, UARK. Rare. Also reported from Mexico, Guatemala, Jamaica, Dominican Republic, Puerto Rico, Antigua, Guadeloupe, Martinique, Dominica, Venezuela and Argentina.

* *Trichia affinis* de Bary 1870: PMFTL, PWF; DBW; first published report for Costa Rica; UARK. Rare. Also reported from Mexico, Panama, Cuba, Trinidad, Ecuador and Chile.

botrytis (J.F. Gmel.) Pers. 1794: PWFTL, MRF; DBW, TW, LC; 7, 10; USJ, UARK. Occasional. Also reported from Mexico, Jamaica, Dominican Republic, Brazil, Chile and Argentina.

* *contorta* (Ditmar) Rostaf. 1875: LMRF, SRP; DBW; first published report for Costa Rica; M. Rare. Also reported from Mexico, Brazil and Chile.

decipiens (Pers.) T. Macbr. 1899: LMWF, MRF; DBW, GL, AL; 3, 4, 7, 10; USJ, BPI, UARK, M. Common. Also reported from Mexico, Guatemala, Cuba, Jamaica, Puerto Rico, Venezuela, Brazil, Ecuador, Chile and Argentina.

favoginea (Batsch) Pers. 1794: LMWF, MRF; DBW, GL, AL; 3, 4 7, 10; USJ, BPI, UARK, M. Common. Widespread in the Neotropics (see 10).

* ? *flavicoma* (Lister) Ing 1967: LDF; DBW; first published report for Costa Rica; no vouchers known, but the species seems to have been recorded from the country. Rare. Also reported from Mexico and Dominican Republic.

persimilis P. Karst. 1868: LMWF, MRF; DBW, GL, DU; first published report for Costa Rica; M. Occasional. Also reported from Mexico, Panama, Peru and Chile.

scabra Rostaf. 1875: MRF; DBW, GL; 3, 4, 10; BPI, UARK, M. Rare. Also reported from Mexico, Jamaica, Colombia, Venezuela, Brazil, Ecuador and Argentina.

varia (Pers. ex J.F. Gmel.) Pers. 1794: PWFTL; DBW; 3, 4, 10; USJ, BPI, UARK. Rare. Also reported from Mexico, Cuba, Jamaica, Venezuela, Ecuador, Chile, Paraguay and Argentina.

verrucosa Berk. 1859: MRF; DBW, GL; 3, 4, 7, 10; USJ, UARK, M. Occasional. Also reported from Mexico, Cuba, Jamaica, Dominica, Colombia, Brazil, Chile and Argentina.

Tubifera bombarda (Berk. & Broome) G.W. Martin, Brittonia 13:110 (1961): LWF, PWF; GL; 3, 4, 8, 10; USJ, BPI, M. Rare. Also reported from Jamaica, Puerto Rico, Venezuela, French Guiana and Brazil. Several of the specimens collected in Costa Rica lack any evidence of the bristle-like pseudocapillitium so characteristic of this species and may represent a distinct taxon.

* *casparyi* (Rostaf.) T. Macbr., N. Amer. Slime-Moulds 157 (1899): PWFTL; LC; first published report for Costa Rica; UARK. Rare. Also reported from Mexico and Argentina.

ferruginosa (Batsch) J.F. Gmel., Syst. Nat. 2:1472 (1792): MRF, PRF, PMF; DBW; 3, 4, 10; USJ, BPI, UARK, M. Occasional. Also reported from Mexico, Panama, Jamaica, Dominican Republic, Puerto Rico, Guadeloupe, Dominica, French Guiana, Brazil, Ecuador, Chile and Argentina.

microsperma (Berk. & M.A. Curtis) G.W. Martin, Mycologia 39(4):461 (1947): PWFTp, LMF, LMFTP, LMRF; DBW; 3, 4, 10; USJ, BPI, UARK, M. Occasional. Widespread in the Neotropics (see 10).

Wilkomlangea reticulata (Alb. & Schwein.) Kuntze 1891 ☰ *Cienkowskia reticulata* (Alb. & Schwein.) Rostaf. 1874: MRF; DBW; 3, 4, 10; no vouchers known. Rare. Also reported from Mexico, Belize, Panama, Venezuela, Brazil, Peru, Uruguay and Argentina.