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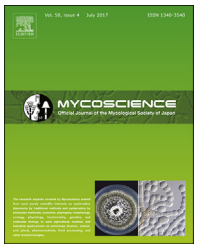

Full paper

Corticolous myxomycetes assemblages in a seasonally dry tropical forest in Brazil

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ABSTRACT

Corticolous myxomycetes are a distinct ecological group consisting of species typically associated with the outer bark surface of living trees. The current study aimed to characterize the community structure of corticolous myxomycetes and their associated trees, analyzing the influence of geographic distance, bark pH, and tree diameter on myxomycete assemblages in a Neotropical Seasonal Dry Tropical Forest (SDTF) in Brazil. The myxomycete community composition significantly varied with the increase of the geographic distance between the studied plots, and tree bark pH was able to explain the species composition exclusively recorded in one of the three transects.

1. Introduction

The monophyletic Myxomycetes lineage, including Myxogastria and Ceratiomyxida (Cavalier-Smith et al. 2015), comprises amoeboid protists with a trophic stage involving a unicellular, multinucleate, plasmodium and a reproductive stage, developing as a sporocarp, where the meiotic spores are produced (Fiore-Donno et al. 2010; Cavalier-Smith 2013). Myxomycetes are ubiquitous in all terrestrial ecosystems across different climates and vegetation zones: (i) tropical [Schnittler and Stephenson 2000 (Central America);

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Stephenson et al. 2004 (South America); Tran et al. 2006 (Asia); Ndiritu et al. 2009 (Africa)]; (ii) temperate (Stephenson 1989; Snell and Keller 2003; Schnittler et al. 2006); (iii) boreal [Schnittler and Novozhilov 1996; Novozhilov et al. 1999 (Asia)]; (iv) tundra [Stephenson et al. 2007 (Southern Hemisphere); Stephenson et al. 2000 (Northern Hemisphere)] and (v) montane/alpine [Ronikier and Ronikier 2009 (worldwide); Novozhilov et al. 2013]. They inhabit litter and woody plant debris, dung and soil, and the surface of living plants and fungi (Stephenson 2011). Environmental factors such as substrate pH, moisture, and temperature influence both trophic and reproductive stages of the myxomycete life cycle, suggesting that distribution in nature is not random (Stephenson 1989; Tesmer and Schnittler 2007; de Lima and Cavalcanti 2015; Liu et al. 2015).

A distinct ecological group of myxomycetes consists of species typically associated with the outer bark surface of living trees (Clayton et al. 2014; Schnittler et al. 2016). The term "corticolous myxomycetes" was originally used to describe these species that complete their entire life cycle on the bark of living trees (Keller and Brooks 1976). As many of the corticolous myxomycetes species are rather inconspicuous, or sporadic in their occurrence, they are difficult to detect in the field (Stephenson 2011). A convenient manner to study them is the moist chamber culture method originally devised by Gilbert and Martin (1933).

The Caatinga phytogeographic domain of Northeastern Brazil is the largest nuclei of Seasonally Dry Tropical Forests (SDTF) that are scattered in the Neotropics (Prado 2000; Queiroz 2006). A dry season in the Caatinga can last 6–11 mo and the mean annual precipitation is less than 1000 mm (Queiroz 2006; Oliveira-Filho et al. 2013). The vegetation in Caatinga exhibits remarkable adaptations that allow it to thrive under strong seasonality. Typically, the woodland is composed of small to medium-sized trees and shrubs, often bearing thorns and small leaves that are deciduous in the dry season (Queiroz 2006). Recently, fossil-calibrated plant phylogenies, dating back to early Miocene, have tracked the ancient evolutionary history of the Caatinga dry woodland (Queiroz and Lavin 2011; Pennington and Lavin 2016). The few studies reporting the occurrence of corticolous myxomycetes species in the Caatinga (Gottsberger 1968; Góes-Neto and Cavalcanti 2002; Silva and Cavalcanti 2012) are all taxonomic surveys upon field-collected myxomycete specimens. No study, however, has attempted to understand the community structure of corticolous myxomycetes in the Caatinga. In order to fill this ecological gap, the current study aimed to characterize the community structure of corticolous myxomycetes and their associated trees, and to analyze the influence of geographic distance, bark pH, and tree diameter on myxomycetes assemblages within the seasonally dry setting of the Brazilian Caatinga.

2. Material and methods

2.1. Study area

The study area is a fragment of seasonally dry tropical forest (Biome Caatinga) located in the northeastern of Brazil (municipality of Ipirá in the state of Bahia) (12°10′36.1″S–12°10′51.3″S; 39°46′10.2″W–39°46′14.9″W; elevation: 280 m). The site is a remnant of a previously larger pristine forested area. The region has a tropical semiarid climate with a mean annual temperature of 23.7 °C and a mean annual rainfall of 754 mm, mainly concentrated in winter (Jun–Jul), corresponding to BSw in Köppen system of climate classification (Kottek et al. 2006).

2.2. Sampling strategy

The point-center quarter method (PCQM) was used to survey the tree community (Cottam and Curtis 1956). A total of 30 points was distributed along three 100 m long transects. The distance between each point was 10 m, so that each transect contained 10 points. The nearest tree to the sampling point in each one of the four quarters was sampled. The following inclusion criteria for selection of the trees were adopted: (i) trees with fissured outer bark and (ii) DBH (trunk diam at breast height) $\geq$ 2 cm at 1.30 m above the soil. A fragment of bark with about 10 cm was sampled from each host tree with a sterile knife, taking care not to damage the underlying tree living tissues, and the samples were deposited in sterile plastic bags.

2.3. Moist chambers

Moist chambers were made with collected substrata using 9-cm plastic Petri dishes covered with a sterilized paper filter at the bottom. A total of 118 moist chambers was prepared, comprising one for each sampled individual tree. Substrata were placed on the filter paper and sterilized distilled water (pH 7.0) was added enough to submerge the material (Mitchell 1977). After 24 h, the excess of water was drained off and pH (Digimed, DM20, Brazil) was measured (Stephenson 1985). Moist chambers were incubated in the laboratory in a diffuse light/dark environment at room temperature (23–25 °C) and examined, initially daily, and later twice a week, during two months, with a stereomicroscope, for the presence of plasmodia and/or sporocarp. Plasmodia types were classified as protoplasmodium, aphanoplasmodium, phaneroplasmodium or intermediate (trichiaceous) plasmodium (Everhart and Keller 2008). A group of sporocarps originated from the same plasmodium was considered as an individual (Eliasson 1981).

2.4. Identification of myxomycetes and trees

Trees were sampled according to standard botanical methods (Mori et al. 2011) and vouchers of living trees were identified at species level using taxonomic keys from specific literature (Queiroz 2009), and stored in the Herbarium of the State University at Feira de Santana (HUEFS). The tree families are circumscribed according to the phylogenetic classification proposed by the Angiosperm Phylogeny Group (Byng et al. 2016). The myxomycetes were identified using taxonomic identification keys (Martin and Alexopoulos 1969; Lado and Pando 1997; Poulain et al. 2011; Lado et al. 2016) and representative samples of each identified species were deposited in the HUEFS.