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Community structure of polypores (Basidiomycota) in a restored Brazilian Forest

Estrutura da comunidade de políporos (Basidiomycota) em uma floresta brasileira restaurada

Alcantara, Alex A.[1]*; Ricardo M. Pires[1,2]; Eduardo P. C. Gomes[1]; Luiz M. Barbosa[1]; Adriana M. Gugliotta[1]

[1] Instituto de Pesquisas Ambientais, Av. Miguel Stéfano, 3687, São Paulo, CEP 04301-012, SP, Brazil.
[2] UNESP - Instituto de Biociências - Campus de Botucatu. Depto. de Bioestatística, Biologia Vegetal, Parasitologia e Zoologia. R. Prof. Dr. Antônio Celso Wagner Zanin, 250 – Distrito de Rubião Junior – Botucatu, CEP 18618-068, SP, Brazil.
* Corresponding author: <alex.ex100@gmail.com>

ABSTRACT

Polypores (Basidiomycota) are of great importance in several forest areas since they are fundamental for wood decomposition and nutrient recycling, which is essential for the functioning of ecosystems. This study assessed the polypore community structure in a restoration area and its use as a parameter to monitor restoration. Our study was carried out in Parque Florestal São Marcelo *Private Natural Heritage Reserve* (RPPN), a protected area of 240 ha, formed in 2002 from reforestation with native species, 13 years after the restoration measures. The polypore community in the area was characterized according to the richness, abundance, and functionality. Results were compared with data from two natural reference areas near the study site and in the same forest type, i.e., riparian forest, but with different land use history. One hundred and eighteen specimens belonging to 31 species were collected; 6.45% were abundant (*Funalia rigida* and *Pycnoporus sanguineus*), 12.90% common, 32.26% occasional, and 48.39% rare. Four functional groups based on the species' relative frequency on each substrate were found. Higher frequency of polypores was observed in substrates of smaller diameter (dead branches). The restored area showed a similar richness to the preserved area used as reference. In addition, the

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polypore community showed a structure similar to well-established areas. This result indicates that the RPPN restoration project was successful and that the polypore community structure can be suitable for evaluating and monitoring regions restored over time.

Keywords — Atlantic Forest; ecological indicators; Hymenochaetales; Polyporales; restoration.

RESUMO

Os políporos (Basidiomycota) são organismos de grande importância em diversas áreas florestais, visto que são fundamentais na decomposição da madeira e reciclagem de nutrientes, essenciais ao funcionamento dos ecossistemas. O presente estudo avaliou a estrutura da comunidade deste grupo de fungos em uma área em restauração e a sua utilização como parâmetro de monitoramento da restauração. O estudo foi realizado na Reserva Particular do Patrimônio Natural (RPPN) Parque Florestal São Marcelo (240 ha), formada a partir de um reflorestamento com espécies nativas em 2002, após 13 anos do processo de restauração. A comunidade de políporos da área foi caracterizada de acordo com riqueza, abundância e funcionalidade. Os dados foram comparados à duas áreas naturais de referência próximas ao local de estudo e de mesma formação florestal, i.e, floresta ripária, mas com diferentes histórias de ocupação do solo. Foram coletados 118 espécimes pertencentes a 31 espécies; 6,45% foram classificadas como abundantes (*Funalia rigida* e *Pycnoporus sanguineus*), 12,90% comuns, 32,26% ocasionais e 48,39% raras. Quatro grupos funcionais foram encontrados com base na frequência relativa das espécies em cada substrato. Maior frequência de políporos foi verificada em substratos de menor diâmetro. Os resultados indicaram que a riqueza na área restaurada está no mesmo nível da área conservada utilizada como referência, mostrando que o projeto de restauração da RPPN foi bem-sucedido e que a estrutura da comunidade de políporos pode ser um bom parâmetro de avaliação e monitoramento de áreas restauradas ao longo do tempo.

Palavras-chave — Hymenochaetales; indicadores ecológicos; Mata Atlântica; Polyporales; restauração.

INTRODUCTION

Polypores are fungi of the phylum Basidiomycota with a tubular hymenophore. They are primarily wood-decaying fungi and play critical roles in plant matter decomposition (Ryvarden, 1991). The ecological importance of polypores is widely known. Since wood is the largest component in the biosphere, representing more than 90% of the biomass in forest ecosystems, the role of lignicolous species in nutrient cycling and maintenance of terrestrial ecosystems is of paramount importance (Glazer & Nikaido, 1995; Rayner, 1995; Boddy *et al.*, 2008).

The scarcity of information on the diversity and structure of the polypore community in the different Brazilian biomes explains the exclusion of these fungi from restoration studies. Although there are recent contributions to ecological aspects of this fungal group (Gibertoni *et al.*, 2007, 2015; Drechsler-Santos *et al.*, 2010; Nogueira-Melo *et al.*, 2014, 2017, Soares *et al.*, 2014; Borba-Silva *et al.*, 2015; Medeiros & Cattanio, 2015; Komonen *et al.*, 2018; Abrahão *et al.*, 2019; Leonardo-Silva *et al.*, 2020), no data is available on the polypore diversity in restored areas or under the restoration process in Brazil.

Monitoring studies seek to use indicators demonstrating whether reforestation has recovered its ecological functions efficiently (Viani *et al.*, 2017). Most parameters used as indicators refer to the plant community, such as diversity and species richness, basal area, average height, rainfall, seed bank, understory seedling composition, canopy, and presence of invasive species (Colmanetti, 2013; Gandolfi, 2013; Viani *et al.*, 2017). Other indicators, such as the presence of fauna, generally associated with the dispersion of plant species, have also been evaluated (Silveira *et al.*, 2011; Cross *et al.*, 2019).

Nowadays, deadwood is increasingly recognized as an important component in the functioning of forest ecosystems and is becoming an integrated part of forest management (Merganièová *et al.*, 2012, Kuntuu *et al*., 2015).

Biodiversity recovery (i.e., the rate of recovery to a pre-disturbance state) is a primary outcome for most forest restoration interventions, especially because biodiversity is a surrogate for many benefits of restoring ecosystems. Thus, to assess restoration effectiveness on biodiversity recovery it is necessary to integrate different biodiversity metrics and different organisms (Romanelli *et al*., 2022).

Despite being essential to the functioning of terrestrial ecosystems restoration success, woody-decay fungi are often neglected in ecological monitoring and restoration studies in Brazil, although they have been considered in other regions, mainly in temperate and boreal zones (Pentillä *et al.*, 2013; Pasanen *et al.*, 2014; Gallo *et al.*, 2015; Elo *et al.*, 2019).

Several studies have shown that the area's conservation status directly affects the polypore community, suggesting their potential application in monitoring forest restoration.

In São Paulo state, Abrahão *et al.* (2019) evaluated the wood-decay Agaricomycetes (Basidiomycota) diversity in two areas with different vegetation types and conservation states. Their results revealed that the vegetation type and the area's conservation degree influenced fungal diversity.

We hypothesized that the polypore diversity in the area under restoration is lower than in the conserved natural area used as reference. Therefore, our study aimed to assess whether the fungal community has become established in an ecotone restoration area between savannah and semi-deciduous forest in São Paulo state, southeastern Brazil. In addition, we also sought to understand the structure of a polypore community and its application as a parameter for monitoring restoration.

MATERIAL AND METHODS

Study area

The Parque Florestal São Marcelo *Private Natural Heritage Reserve* (RPPN) has 240 hectares and is located in the municipality of Mogi Guaçu (Fig. 1), State of São Paulo, Brazil (22º21'51"- 22º23'40"S, 46º58 '28 "- 46º59' 46"W). The area was occupied by annuals and semi-perennials crops such as sugar cane, and perennials, such as coffee and citrus, and since 1995, by pastures and eucalyptus. The reserve was implemented in 2002 through reforestation with more than 100 native trees, with a high diversity of pioneer and non-pioneer species (Barbosa *et al.*, 2013). It is located in a mosaic of land covers, including remnants of seasonal semi-deciduous forest, eucalyptus plantations, other anthropogenic land covers, and heterogeneous reforested areas; remnants of the Cerrado biome (Neotropical Savannah) are also found around the RPPN (Colmanetti *et al*., 2016).

The region's climate is subtropical with dry winter and hot summer (classified as Cwa according to Köppen's climate classification, Alvares *et al.*, 2013), with a mean annual temperature of 21.7°C and rainfall of 1,325mm (Embrapa, 2017). Colmanetti & Barbosa (2013) and Colmanetti *et al.* (2016) described the structure of the area's regenerating tree and plant community.

Collection and sampling

Collections were carried out bi-monthly during October 2015-October 2016 (totaling seven collections) in two sampling blocks, RPPN-A and RPPN-B (Fig. 1). The blocks have a similar composition and structure (2,475 and 2,405 m^2/ ha, respectively, Colmanetti, 2013). In each block, ten 4 x 50 m transects were sampled.

All woody substrates were observed. The basidiomes were collected according to Fidalgo & Bononi (1984), labeled for follow-up, specificity assessment, and avoid the record of the same individual in different field expeditions (Lodge *et al.*, 2004).

Specimens were stored in paper bags, and all collection data were recorded, including data about the substrate (e.g., diameter, whether collected from a branch or a trunk, etc.). Species identification was based on the basidioma morphological characteristics (Ryvarden, 1991; Teixeira, 1995), using Ryvarden & Johansen (1980), Ryvarden (1991, 2004, 2015, 2016), Núñez & Ryvarden (2000), Rajchenberg (2006), Gugliotta *et al.* (2011), Motato-Vásquez *et al.* (2013, 2014), Pires *et al.* (2015, 2016, 2017), Kaipper-Figueiró *et al.* (2016), Pires & Gugliotta (2016), Palacio *et al.* (2017, 2021), Chen *et al.* (2020), Lira *et al.* (2021). Selected specimens were deposited in the Herbarium SP.

Analysis of the polypore community

The richness and abundance of the polypore community were characterized (Magurran, 2004). All basidiomes of the same species found on a single substrate were considered as one occurrence/individual (Zak & Willig, 2004).

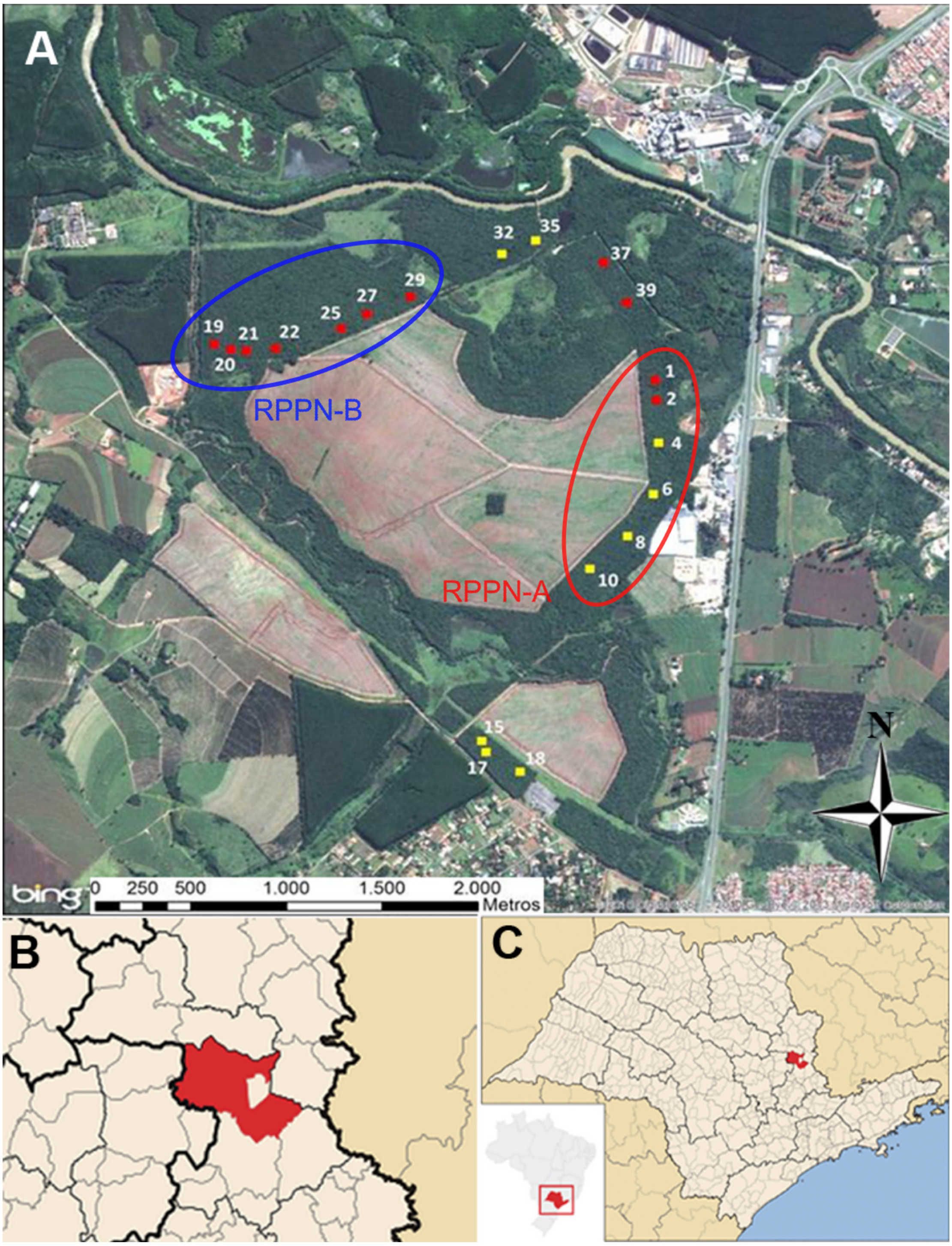

Fig. 1. Location map of the study area. A) Parque Florestal São Marcelo *Private Natural Heritage Reserve* (RPPN) (Barbosa *et al.* 2013). B) Municipality of Mogi Guaçu. C) Map of the state of São Paulo in Brazil, with emphasis on the location of the Municipality of Mogi Guaçu.

Fig. 1. Mapa de localização da área de estudo. A) Reserva Particular do Patrimônio Natural Parque Florestal São Marcelo (RPPN) (Barbosa *et al*. 2013). B) Município de Mogi Guaçu. C) Mapa do estado de São Paulo no Brasil, com destaque para a localização do Município de Mogi Guaçu.

Species were classified according to their abundance (N), that is, the absolute value of the number of occurrences of the species, and species relative frequency (RF), calculated using the formula: $RFx = (nx \times 100)/N$, where nx = number of occurrences of each polypore species and N = total number of occurrences of all polypore species in all plots and sampling dates (Magurran, 2004; Urcelay & Robledo, 2004; Zhou & Dai, 2012).

The frequency classes (FC) of each species were designated according to Soares *et al.* (2014), and Leonardo-Silva *et al.* (2020), using the following criteria: $0.5 < RF \leq 1.5\%$ rare (R); $1.5 < RF \leq 5\%$, occasional (O); $5 < RF \leq 10\%$ common (C); $RF > 10\%$ abundant (A).

To verify the functional groups, the relative frequency of the species (RF_{xi}) on each substrate condition: dead branch (DB), dead trunk (DT), live branch (LB), and live trunk (LT), or on the ground (OG), was calculated using the formula $RF_{xi} = (n_{xi} \times 100)/Rt_x$: RF_{xi} = relative frequency of each polypore species "x" in the substrate condition "i", n_{xi} = number of occurrences of the polypore species "x" in the substrate condition "i" and Rt_x = number of total occurrences of the polyporous species "x" (Urcelay & Robledo, 2004; Borba-Silva *et al.*, 2015). The substrates were considered branches if they presented up to 5 cm in diameter and trunks above this value.

Based on the matrix of relative species frequencies per substrate, a cluster analysis was performed using the relative Euclidean distance, with the average group linkage method in the Past 3.15 software (Hammer *et al.*, 2001). For the relative Euclidean distance, the total per substrate was standardized so that all substrates have the same contribution to the distance matrix (Ludwig & Reynolds, 1988). Only species with at least two occurrences were included in the analysis.

Data were compared to two natural reference areas (A and B) near the study site and with the same forest formation, i.e., riparian forest (Abrahão, 2012; Abrahão *et al.*, 2019), but with different land use history.

Area A covered 343.42 ha and comprised "Cerrado" vegetation at a medium regeneration stage; was used in the past for cultivation, wood removal, and cattle grazing, and lately for research in general (Mantovani & Martins, 1993; Giudice-Neto, 2015). Area B covers 126.63 ha, with a semi-deciduous forest; the original forest is in good condition (no exotic species, large gaps, or herbaceous climbers).

Individual rarefaction analysis was performed to compare the areas (Krebs, 1989) independent of differences due to sampling intensities, with a respective confidence interval of 95%. Data were processed using the Past 3.15 software (Hammer *et al.*, 2001). Distance matrix (relative Euclidian Distance) between of different polypore species of the RPPN - Parque Florestal São Marcelo *Private Natural Heritage Reserve* and reference areas (A_RF and B_RF), based on relative frequency of the species was performed. Species identified only to genera were not included in analysis.

Fig. 2. Polypores (Agaricomycetes) from Parque Florestal São Marcelo *Private Natural Heritage Reserve* (RPPN): A) *Favolus rugulosus.* B) *Neofavolus subpurpurascens.* C) *Megasporoporia neosetulosa.* D) *Polyporus tricholoma.* E) *Trullella duracina.* F) *Pycnoporus sanguineus.*

Fig. 2. Políporos (Agaricomycetes) da Reserva Particular do Patrimônio Natural (RPPN) Parque Florestal São Marcelo: A) *Favolus rugulosus*. B) *Neofavolus subpurpurascens*. C) *Megasporoporia neosetulosa*. D) *Polyporus tricholoma*. E) *Trullella duracina*. F) *Pycnoporus sanguineus*.

RESULTS AND DISCUSSION

One hundred and eighteen specimens were collected, and 31 species were identified (Table 1). Some polyporous species were already recorded for São Paulo state (Fig. 2), such as *Polyporus tricholoma*, *Pycnoporus sanguineus*, and *Trullella duracina* (Maia *et al.*, 2015). *Favolus rugulosus* and *Megasporoporia neosetulosa* are cited for the first time for São Paulo state since they were recently described after confirming their phylogenetic position. *Favolus rugulosus* was commonly cited in Brazil as *Polyporus philippinensis* Berk., described for the Philippines (Palacio *et al.*, 2021), and *M. neosetulosa* was widely reported in Brazil as *Megasporoporia setulosa* (Henn.) Rajchenb., which appears to be restricted to Africa (Lira *et al.*, 2021). *Neofavolus subpurpurascens* is also reported in the state of São Paulo for the first time (Alcantara *et al.*, 2019) and a new species of *Neofavolus* was revealed (Alcantara, 2017).

Table 1. Polypore species in the Parque Florestal São Marcelo *Private Natural Heritage Reserve* (RPPN): Number of specimens (N), Relative Frequency (RF) and Frequency Class (FC): abundant (A), common (C), occasional (O), rare (R).; and relative frequency of polypore species in the substrate conditions: dead branch (DB), dead trunk (DT), living branch (LB), living trunk (LT).

Tabela 1. Espécies de políporos na Reserva Particular do Patrimônio Natural Parque Florestal São Marcelo (RPPN): Número de espécimes (N), Frequência Relativa (RF) e Classe de Frequência (FC): abundante (A), comum (C), ocasional (O), raro (R).; e frequência relativa de espécies de políporos nas condições de substrato: galho morto (DB), tronco morto (DT), galho vivo (LB), tronco vivo (LT).

Species	N	RF	FC	DB	DT	LB	LT
Funalia rigida (Berk. & Mont.) Peck	22	18.64	A	82	18	-	-
Pycnoporus sanguineus (L.) Murrill	14	11,86	A	100	-	-	-
Trametes villosa (Sw.) Kreisel	11	9.32	C	100	-	-	-
Hexagonia papyracea Berk.	7	5.93	C	100	-	-	-
Trullella duracina (Pat.) Zmitr.	7	5.93	C	71	29	-	-
Irpex lacteus (Fr.) Fr.	6	5.08	C	100	-	-	-
Favolus brasiliensis (Fr.) Fr.	5	4.23	O	100	-	-	-
Hexagonia hirta (P. Beauv.) Fr.	5	4.23	O	80	-	-	20
Antrodia neotropical Kaipper-Figueiró, Robledo & Drechsler-Santos	4	3.39	O	100	-	-	-
Megasporoporia neosetulosa C.R.S. Lira & Gibertoni	4	3.39	O	75	-	25	-
Fomitiporia maxonii Murrill	4	3.39	O	75	25	-	-
Favolus rugulosus Palacio & R.M. Silveira	4	3.39	O	100	-	-	-
Neofavolus subpurpurascens (Murrill) Palacio & Robledo	3	2.54	O	100	-	-	-
Trametes pubescens (Schumach.) Pilát	3	2.54	O	100	-	-	-
Fuscoporia senex (Nees & Mont.) Ghobad-Nejhad	2	1.69	O	50	-	-	50
Gloeoporus dichrous (Fr.) Bres.	2	1.69	O	100	-	-	-
Ceriporia xylostromatoides (Berk.) Ryvarden	1	0.85	R	100	-	-	-
Xylodon sp.	1	0.85	R	100	-	-	-
Ceriporiopsis flavilutea (Murrill) Ryvarden	1	0.85	R	100	-	-	-
Funalia caperata (Berk.) Zmitr. & V. Malysheva	1	0.85	R	100	-	-	-
Trametes decipiens Bres.	1	0.85	R	100	-	-	-
Fuscoporia punctatiformis (Murrill) Zmitr., Malysheva & Spirin	1	0.85	R	100	-	-	-
Ganoderma australe (Fr.) Pat.	1	0.85	R	-	100	-	-
Hexagonia hydnoides (Sw.) M. Fidalgo	1	0.85	R	-	100	-	-
Phellinus undulatus Murrill) Ryvarden	1	0.85	R	-	100	-	-
Neofavolus sp.	1	0.85	R	100	-	-	-
Polyporus guianensis Mont.	1	0.85	R	100	-	-	-
Neodictyopus atlanticae Palacio, Robledo & Drechsler-Santos	1	0.85	R	100	-	-	-
Polyporus leprieurii (Pers.) Schwein	1	0.85	R	100	-	-	-
Polyporus tricholoma Mont.	1	0.85	R	100	-	-	-
Xylodon flaviporus (Berk. & M.A.Curtis ex Cooke) Riebesehl & E. Langer	1	0.85	R	100	-	-	-

According to the abundance of species, the fungal community was organized into four categories: abundant, common, occasional, and rare. *Funalia rigida* and *Pycnoporus sanguineus* were abundant (6.45%), while 12.90% of the species were classified as common, 32.26% as occasional, and 48.39% as rare (Table 1).

Our results on species frequency corroborate the studies of Borba-Silva *et al.* (2015), Nogueira-Melo *et al.* (2014, 2017), Abrahão *et al.* (2019), and Leonardo-Silva *et al.* (2020). They observed that few species are abundant or common, while most are rare. However, none of these studies were conducted in restored areas, and data on the relative frequency of the recorded species are difficult to compare. The Parque Florestal São Marcelo is located in an ecotone region between the Cerrado (Brazilian savannah) and Atlantic Forest biomes, and many of the polypore species found occur in both biomes. However, the most common polypore species in the restored area (*Funalia rigida*, *Pycnoporus sanguineus* and *Trametes villosa*), are abundant in Cerrado (Abrahão *et al.*, 2019; Leonardo-Silva *et al.*, 2020), but rare in Atlantic Forest biome (Borba-Silva *et al.*, 2015).

Therefore, a study that only considers polypore richness will clearly not serve as a parameter to monitor the restoration process. In addition, the structure of the polypore community should be evaluated in the same vegetation physiognomy. Adarsh *et al.* (2015) analyzed the biological, ecological, and environmental factors of wood decomposition by polypore fungi in the tropics. They suggested that the polypore community reflects the forest vegetation types and that the polypore diversity is reduced in a simplified landscape and maintained in various forest types regionally. They verified that the species richness of wood-decaying polypores was higher in a primary forest plot than in a regenerating forest plot. They also suggested that a low frequency of treefall in the regenerating forest reduced the species richness of wood-decaying fungi.

The lack of substrates in restoration areas can affect the establishment of wood-inhabiting fungi, such as polypores, and dead wood creation has been used in management and restoration of forest ecosystems in Central Finland (Komonen *et al.*, 2014; Elo *et al.*, 2019). By adding dead wood, species richness increased, mainly through increasing abundances: a large amount of dead wood resulted in higher abundance, higher number and faster accumulation of species than a small amount of dead wood. However, the addition of deadwood contained fewer species than natural dead wood. This is most probably because added dead wood was of low diversity and provided habitat only for a limited number of species (Elo *et al.*, 2019).

The polypore richness in the study area was higher than expected, considering it is an area under restoration implemented in 2002. The rarefaction analysis (Fig. 3) shows no significant differences (overlapping of confidence intervals) between the diversity of the sampling blocks in the study area (RPPN-A and RPPN-B) and between them and the most conserved area in Mogi Guaçu Biological Reserve (B-RF area) (considering the 50 specimens collected for all areas).

The similarity analysis from the distance matrix (Relative Euclidean Distance) showed that the restored area presented lower values, i.e., greater similarity with each of the reference areas than the two between them (the greatest distance was between A_RF and B_RF, table 2).

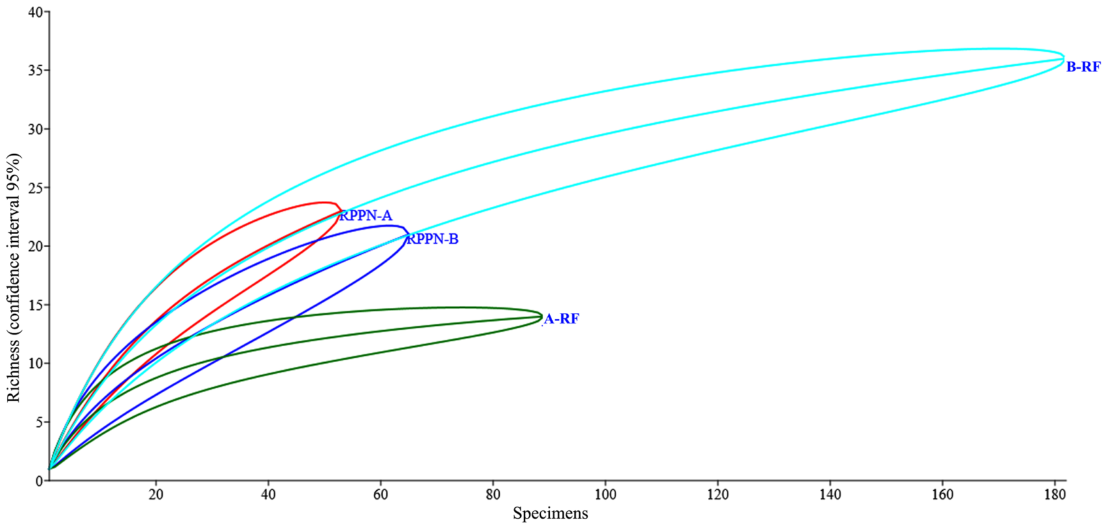

Fig. 3. Rarefaction curve of sampling sites in the RPPN - Parque Florestal São Marcelo *Private Natural Heritage Reserve* (RPPN-A and RPPN-B), and the two natural reference areas A-RF and B-RF (Abrahão *et al.*, 2019). Average of species number (± confidence interval of 95%) for each area in relation to the function of the number of specimens sampled.

Fig. 3. Curva de rarefação dos locais de amostragem na RPPN - Reserva Particular do Patrimônio Natural Parque Florestal São Marcelo (RPPN-A e RPPN-B), e as duas áreas naturais de referência A-RF e B-RF (Abrahão *et al.*, 2019). Média do número de espécies (± intervalo de confiança de 95%) para cada área em relação à função do número de espécimes amostrados.

It should also be noted that the higher richness and abundance recorded in the Mogi Guaçu Biological Reserve (A-RF and B-RF areas) could be due to a greater sampling effort since our study had a shorter sampling period (1 year) than Abrahão *et al.* (2019). The sampling effort indicated that the richness in the study area (Parque Florestal São Marcelo) is even greater than that found, revealing the need to extend the collection period, which is consistent with the recommendations for the study of macrofungal diversity in general (Schmit & Lodge, 2005). However, the results obtained here will serve as a basis for using these fungi in restoration monitoring.

Table 2. Distance matrix (relative Euclidian Distance) between of different polypore species of the RPPN - Parque Florestal São Marcelo *Private Natural Heritage Reserve* and reference areas (A_RF and B_RF), based on relative frequency of the species performed using the relative Euclidean Distance.

Tabela 2. Matriz de distâncias (Distância Euclidiana Relativa) entre as diferentes espécies de polí-poros da RPPN - Reserva Particular do Patrimônio Natural Parque Florestal São Marcelo e as áreas de referência (A_RF e B_RF), com base na frequência relativa das espécies realizada pela Distância Euclidiana Relativa.

	RPPN	A_RF	B_RF
RPPN	0	32,67	38,71
A_RF		0	38,75
B_RF			0

Gallo *et al.* (2015) evaluated the restoration of a reforested area with *Polylepis australis* (Rosaceae) in Argentina. They compared fungal diversity using conserved and degraded native areas without reforestation as references. Their results showed that the diversity of the reforested area, although lower than that of the native area, was much higher than that of the degraded area, suggesting that these fungi are sensitive bioindicators of forest degradation and restoration.

The polypore species were grouped into four functional groups according to the preference for the substrate type. Dead branches showed the highest relative frequency of poroid fungi (Table 1).

Cluster Analysis (Fig. 4) also showed four species groups (Euclidean distance: 3.0) according to the substrate condition. The first group was formed by a single species, *Megasporoporia neosetulosa*, which appeared on live branches, acting as a facultative parasite and then as a saprophyte in the dead substrate. The second group was also formed by a single species, *Fuscoporia senex*, with a relative frequency of 50% on live trunks and 50% on dead branches. As the species of the first group, it acts as a facultative and saprophytic parasite on dead substrates.

The third group was formed by species that decompose larger volume substrates in addition to dead branches. *Funalia rigida* (considered abundant), *Fomitiporia maxonii* (occasional) and *Trullella duracina* (common) are in this group. The fourth group includes the remaining species that occurred exclusively on dead branches of smaller volume, except for *Hexagonia hirta*, which appeared both on live trunks and dead branches. However, it was placed in this group due to their frequency on

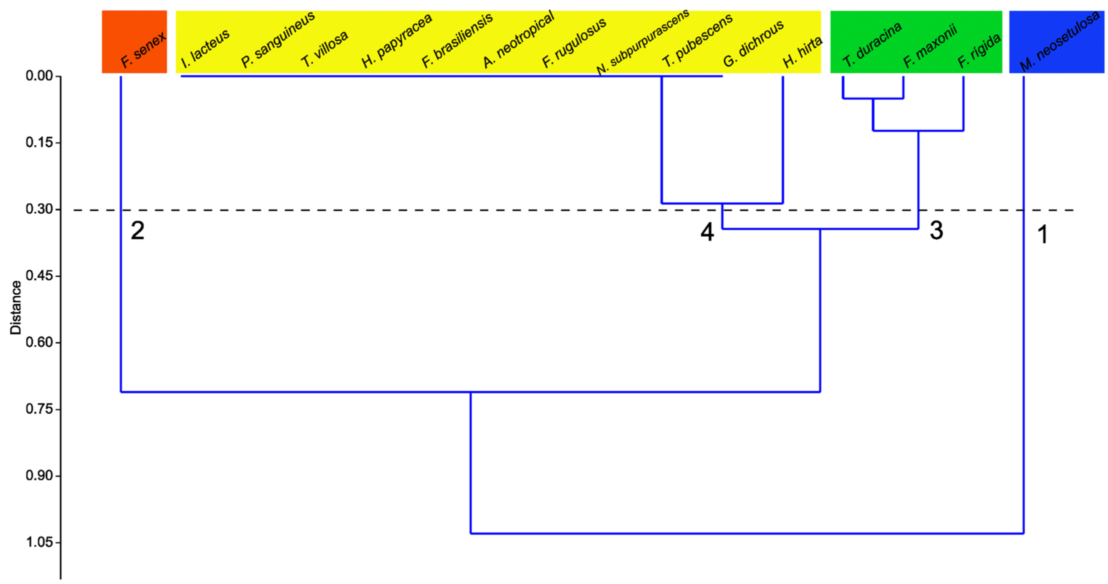

Fig. 4. Cluster analysis of different polypore species of the RPPN - Parque Florestal São Marcelo *Private Natural Heritage Reserve,* based on relative frequency of the species in each substrate condition performed using the relative Euclidean Distance.

Fig. 4. Análise de agrupamento de diferentes espécies de políporos da RPPN - Reserva Particular do Patrimônio Natural Parque Florestal São Marcelo, com base na frequência relativa das espécies em cada condição de substrato realizada utilizando a Distância Euclidiana relativa.

dead branches. This group presented the highest richness (11 species), indicating a preference for dead branches. No soil species were recorded.

Although most polypores are parasitic or saprotrophic, while some are secondary invaders that only establish themselves in partially to severely deteriorated wood, others are quite aggressive and attack wood on living trees and continue to produce basidiomes on the trunk even when the tree is dead (Ryvarden, 1991; Gugliotta & Capelari, 1998; Larsson *et al.*, 2006).

As observed in other studies (Urcelay & Robledo, 2004; Alcantara *et al.*, 2015, Borba-Silva *et al.*, 2015), the highest polypore richness was observed in small-diameter substrates in the restoration study area (RPPN), reinforcing that the size of the substrate is an essential factor that determines fungal diversity.

These data show that although the fungal community studied is located in an area under restoration, it already has a community structure similar to mature areas (Borba-Silva *et al.*, 2015; Urcelay & Robledo, 2004).

These authors also reinforced that each functional group had the same pattern of species frequency by substrate type, including at least one dominant species, some subordinate species, and several rare species. This pattern was also verified in the RPPN in the most numerous group, including branch decomposers, with one abundant, three common, and six occasional species.

CONCLUSION

This study revealed new occurrences of polypores in São Paulo state and a new species of *Neofavolus*, highlighting the area's importance in preserving the state's fungal diversity. The areas surrounding the RPPN study area correspond to rural properties. Small forest fragments are represented by riparian fringes of remnant native vegetation, making the RPPN necessary to establish landscape connectivity.

This work demonstrated that the RPPN study area restoration project was successful and that the polypore community is being established appropriately.

The supply of numerous woody substrates from the tree layer found in the restoration area favored the development of these fungi.

Although the assessment of vegetation structure has been considered one of the most accessible and efficient ways to indicate restoration success, the use of multiple indicators may be much more adequate to understand the ecological complexity in the restoration process. Thus, our results suggest that the structure of the polypore community could be a suitable parameter to evaluate and monitor restored areas over time. The species list presented here is the first report of the occurrence of Agaricomycetes fungi in areas under restoration in Brazil. These data will be the basis for using these fungi to monitor restored areas.

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