

Agaricomycetes in the Atlantic Rain Forest in Northeast Brazil

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RESUMO: (Agaricomycetes na Mata Atlântica no Nordeste do Brasil) A Mata Atlântica representa um grupo variado de florestas extra-amazônicas, dentre as quais se destacam, no Nordeste brasileiro, as florestas costeiras e os brejos de altitude. Entre 2011 e 2013, 110 expedições a campo em nove reservas no domínio da Mata Atlântica foram realizadas. Foram coletados 2263 Agaricomycetes que representaram 300 espécies, dentre as quais 14 novas espécies para a ciência e várias novas ocorrências para o continente, país, regiões, domínio e estados. Além do material recentemente coletado, 309 exsiccatas de Agaricomycetes depositadas no Herbário URM foram revisadas, representando 38 espécies, das quais várias novas ocorrências para a região e estados. Os resultados mostram a importância da realização contínua de inventários e também de revisões de material depositados em herbários como ferramentas para incrementar o conhecimento sobre a micota brasileira.

Palavras-chave: fungos macroscópicos, Basidiomycota, diversidade

ABSTRACT: The Atlantic Rain Forest represents a group of extra-amazonic forests, among which the coastal and montane (“brejos de altitude”) stand out in Northeast Brazil. Between 2011 and 2013, 110 field trips were performed in nine reserves in the domain of the Atlantic Rain Forest. Two thousand two hundred sixty three Agaricomycetes were collected and represented 300 species, among which 14 new species to science and several new occurrences to the continent, country, region, domain and States were found. Besides the recently collected material, 309 exsiccates of Agaricomycetes deposited in the Herbarium URM were revised and represented 38 species, among which several new occurrences

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to the region and States. The results indicate the importance of the constant inventories and also of revisions of material deposited in herbaria as tools to improve the knowledge about the Brazilian micota.

Key words: macroscopic fungi, Basidiomycota, diversity

Introduction

The Agaricomycetes is a group of Basidiomycota characterized by the production of sexual spores (basidiospores) outside specialized cells (basidia) usually in macroscopic structures named basidiomata. These basidiomata are usually known as mushrooms, toadstools, bracket fungi, coralloid fungi, boletes, puffballs, earth stars, bird's nest, among others (Alexopoulos *et al.*, 1996).

These fungi are usually the main decomposers of organic matter in the ecosystems, playing a crucial role in nutrient cycling. Some of them are ectomycorrhizae, while a few can be parasites on living trees (Alexopoulos *et al.*, 1996; Kendrick, 2000; Deacon, 2006).

In Northeast Brazil, the Agaricomycetes have been collected in the Atlantic Rain Forest and studied for a long time (Baltazar & Gibertoni, 2009), but ecosystems such as “brejos de altitude” (montane forests in the semi-arid region) are usually neglected. Besides, new species and/or new occurrences have recently been found even in already well explored localities (Baltazar *et al.*, 2013; Coimbra *et al.*, 2013a, b; Pinheiro & Wartchow, 2013; Trierveiler-Pereira & Baseia, 2013; Alfredo *et al.*, 2014; Cruz *et al.*, 2013; Cabral *et al.*, 2014; Gibertoni & Ryvardeen, 2014). This demonstrates that, despite being conspicuous organisms, the knowledge about their diversity is still underestimated.

Thus, this research had the aim to improve the knowledge about the diversity of these fungi in the Atlantic Rain Forest and its enclaves in Northeast Brazil.

Material and Methods

According to the Decree nº 750/93, the term Atlantic Rain Forest can refer to the whole group of extra-amazonic forests: Atlantic Ombrophylous Dense Forest, Mixed Ombrophylous Forest, Open Ombrophylous Forest, Semi-Deciduous Stational Forest, Deciduous Stational Forest, mangroves, sandbank vegetation, high fields, and montane forests. In Northeast, it comprises isolated islands of vegetation inland (montane forests) and coastal forests (Veloso *et al.*, 1991; Tabarelli *et al.*, 2006; Alves *et al.*, 2009).

Field trips were undertaken in areas of coastal and montane forests (Tab. 1) and Agaricomycetes were collected. Additionally, material previously collected in the same domain and deposited in the Herbarium URM of the Departamento de Micologia of the Universidade Federal de Pernambuco was revised.

For identification of both recently collected material and already deposited in URM, the basidiomata were analyzed macro- (shape, color, hymenial surface) and micromorphologically (hyphal system, presence/absence and measurements of sterile structures and basidiospores). Microscopical observations were made from slide preparations with 5% KOH, stained with 1% of aqueous phloxine, and Melzer's reagent (Singer, 1986; Ryvardeen, 1991).

Besides morphological analysis, specialized literature was used (Singer & Digilio, 1951; Reid, 1965; Pegler, 1977, 1983a, b, 1986, 1997; Ryvardeen & Johansen, 1980; Hallenberg, 1985; Gilbertson & Ryvardeen, 1986, 1987; Singer, 1986; Boidin & Lanquetin, 1987; Hjortstam *et al.*, 1987; Chamuris, 1988;

Table 1. Data about the localities where field trips were undertaken in Northeast Brazil.

Locality/Reserve	Municipality	State	Coordinates	Atlantic Rain Forest type of vegetation
Campus of UFPE	Recife	PE	8° 03' S 34° 56' W	Urban area in the domain of lowland forest
Jardim Botânico de Recife	Recife	PE	08° 04' S 34° 59' W	lowland
Floresta Nacional Araripe-Apodi	Crato	CE	7°21' S 39°26' W	montane
Reserva Biológica de Saltinho	Tamandaré	PE	8° 43' S 35° 10' W	lowland
Reserva Ecológica de Dois Irmãos	Recife	PE	08° 01' S 34° 56' W	lowland
Reserva Ecológica Estadual Mata do Pau Ferro	Areia	PB	6° 59' S 35° 45' W	montane
Reserva Particular do Patrimônio Natural Frei Caneca	Jaqueira	PE	08° 42' S 35° 51' W	lowland
Serra de Ibiapaba	Tianguá	CE	3°52' S 40°57' W	montane
Sítio Carro Quebrado	Triunfo	PE	7°50' S 38°06' W	montane

Hjortstam & Ryvarden, 1989; Ryvarden, 1991, 2004, 2005; Stalpers, 1996; Núñez & Ryvarden, 1995, 1997, 2000, 2001; Léger, 1998). Colour designations followed Watling (1969). Nomenclature followed the databases Mycobank (www.mycobank.org) and Index Fungorum (www.indexfungorum.org).

The newly collected specimens were deposited in the Herbarium Pe. Camille Torrend, Departamento de Micologia, UFPE (URM).

Results

After 37 field trips for agaricoid, 18 for clavarioid and stereoid, 12 for corticioid, and 43 for poroid fungi collection, 2263 agaricoid, corticioid, clavarioid, poroid and steroid Agaricomycetes were collected and represented 300 species. Fourteen are new to science, while many others are new occurrences to the continent, Brazil, Northeast region, the Atlantic Rain Forest and some States (Tab. 2). The identified species are being mostly published in the Lista de Espécies da Flora do Brasil (<http://floradobrasil.jbrj.gov.br/jabot/listaBrasil/PrincipalUC/PrincipalUC.do>) or in congresses abstracts. The new species and new occurrences are being (e. g., Coimbra *et al.*, 2012, 2013a, b) or will be published separately.

Table 2. Diversity of Agaricomycetes collected in areas listed in Table 1 (SA = South America, BR = Brazil, NE = Northeast region, ARF = Atlantic Rain Forest, CE = Ceará State, PB = Paraíba State, PE = Pernambuco State).

Group	Number of collected specimens	Number of identified species	New occurrences	New species
Agaricoid	57	37	1 BR 11 NE, 3 PE	4
Clavarioid	14	10	1 NE	2
Corticioid	634	105	2 SA, 6 BR 14 NE, 4 ARF 1 CE, 1 PB 4 PE	8
Poroid	1550	145	1 SA, 4 BR 11 NE, 13 CE 2 PB, 7 PE	-
Stereoid	8	3	2 NE	-
TOTAL	2263	300	-	14

Besides the material recently collected, 309 exsiccates of agaricoid, clavarioid, poroid and steroid Agaricomycetes deposited in URM were analysed and represented 38 species (Tab. 3). Several new occurrences for the Northeast region and States were discovered.

Table 3. Diversity of Agaricomycetes deposited in URM (NE = Northeast region, AL = Alagoas States, BA = Bahia State, PE = Pernambuco State).

Group	Number of exsiccates analysed	Number of identified species	New occurrences
Agaricoid	36	8	-
Clavarioid	26	6	2 NE
Corticoid	3	1	-
Poroid	225	20	1 NE, 1 AL 1 BA, 4 PE
Stereoid	19	3	-
TOTAL	309	38	-

Discussion

So far, 390 species have been reported to the domains of the Atlantic Rain Forest in Northeast Brazil (187 species of agaricoid, 25 of corticioid, one of clavarioid, 167 of poroid and 10 of steroid Agaricomycetes) (Batista & Silva, 1951; Batista, 1957; Batista & Vital, 1958; Batista & Bezerra, 1960; Singer, 1955, 1961a, b, 1964, 1965, 1973, 1976, 1977, 1982; Kimbrough *et al.*, 1994/1995; Alves & Cavalcanti, 1996; Maia *et al.*, 2002; Wartchow, 2006, 2009; Drechsler-Santos *et al.*, 2007a, b; Wartchow & Maia, 2007; Wartchow *et al.*, 2007a, b, c, d, 2008a, b, 2010a, b; Baltazar *et al.*, 2010, 2012, 2013).

After field trips (Tab. 2) and herbarium revision (Tab. 3), 60 species were added to what was previously known to the Atlantic Rain Forest in Northeast Brazil and represented an increase of about 15% in the Agaricomycete diversity in the domain in the region. Most of these additions were due to the inclusion in the researches of the corticioid fungi, a group usually neglected due to its inconspicuousness and the little amount of literature for its identification based on tropical material. However, poroid fungi, conspicuous, easily collected and conserved, and object of several monographs for several continents (Ryvarden & Johansen, 1980; Gilbertson & Ryvarden, 1986, 1987; Ryvarden, 1991, 2004,

2005; Stalpers, 1996; Núñez & Ryvarden, 1995, 2000, 2001) also contributed with significant additions to the previous knowledge about Agaricomycete diversity in the Atlantic Rain Forest in Northeast Brazil. Understudied groups such as agaricoid, corticioid and clavarioid fungi were the main sources for new species. Examples are recent discoveries of new taxa belonging to the agaricoid genera *Entoloma* (Fr.) P. Kumm., *Megacollybia* Kotl. & Pouzar and *Phaeocollybia* R. Heim (Coimbra *et al.*, 2012, 2013a, b), and the clavarioid *Clavulina* J. Schröt. (Wartchow 2012).

These results demonstrates the importance of 1) inventories, both in areas never explored before (such as RPPN Frei Caneca, Flona Araripe-Apodi) as well as in areas frequently visited (such as Reserva Ecológica de Dois Irmãos), 2) herbaria revisions, as already stated by previous works (Gomes-Silva *et al* 2012a, b, c, d, 2013, 2014, Nogueira-Melo *et al.*, 2012), and 3) the inclusion of neglected Agaricomycetes in the surveys to increase the knowledge about fungal diversity in Brazil.

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