Corticioid and poroid fungi (*Basidiomycota*) from Parque Estadual da Serra de Caldas Novas (PESCAN), Brazilian Savanna, Goiás, Brazil

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Abstract— This study was based on specimens collected on 15 field expeditions between 2007 and 2013 in the Parque Estadual da Serra de Caldas Novas (PESCAN), the first conservation unit decreed by the government of the State of Goiás and one of the most representative protected areas of the Brazilian Savanna (Cerrado biome). A list of 51 species composes this inventory, six of them reported for the first time from Cerrado Biome (*Flabellophora parva, Hymenochaete microcycla, Navisporus sulcatus, Stiptophyllum erubescens, Trechispora mellina, and Truncospora ohiensis*), five from the Midwest region of Brazil and two from Goiás. These results increase sampling efforts and knowledge about these fungi in this little-studied region of Brazil.

Keywords—*Agaricomycetes*, Cerrado biome, geographic distribution, polypores, resupinate fungi

Introduction

The Parque Estadual da Serra de Caldas Novas (PESCAN) was created by the government of Goiás, Brazil, in 1970, being the first conservation unit decreed in the State. PESCAN aims to conserve the fauna, flora, springs, and their surroundings, natural sites of ecological and tourist relevance (SEMAD 2021). The park is located in one of the regions with the largest occurrence of thermal waters in Brazil and is one of the most relevant recharge areas of the hydrothermal aquifers in the municipalities of Caldas Novas and Rio Quente. Furthermore, the area constitutes a representative remnant of the Cerrado (Brazilian Savanna), with diverse typical vegetation of the biome (Klink & Machado 2005, SEMAD 2021).

The known biodiversity of PESCAN comprises more than 800 species, including plants, vertebrate animals, insects, amoeboid protists (*Myxomycetes*), and fungi (Alvarenga & Xavier-Santos 2017, Moreira & al. 2019, SEMAD 2021). Among these groups of organisms, the fungi are one of the poorer known with only 10 species of macrofungi (Alvarenga & al. 2015, Calaça & al. 2015, Calaça & Xavier-Santos 2016, Alvarenga & Xavier-Santos 2017, Leonardo-Silva & al. 2020), which supports the need for more sampling efforts in the region.

Corticioid and poroid fungi are some of the common and important wood-inhabiting fungi in forest environments. These macrofungi are traditionally grouped by the morphology of the basidioma and do not represent taxa in any rank. Species with smooth to hydnoid hymenium usually organized in the form of a sheet on the substrate (resupinate) are known as corticioid fungi, and those with the hymenium composed of tubes (pores), poroid fungi or polypores (Ryvarden 2004, Larsson 2007, Ghobad-Nejhad 2011). These groups of fungi are essential components of forest ecosystems by the ecological interactions associated with wood decay, nutrient cycling, soil formation, and symbiosis with plants (Ryvarden 2004, Moore & al. 2011).

Despite the importance of corticoid and poroid fungi, data on their diversity are scarce in the Cerrado, one of the richest biomes in Brazil and most threatened by human activities. We undertook a survey into the diversity of these fungi in the PESCAN and its surroundings and presented an annotated checklist of the species.

Materials & methods

Study area

The PESCAN is located in South America, Central Brazil, in the State of Goiás, between the municipalities of Caldas Novas and Rio Quente (17°47′34″S to 17°50′55″S and 48°40′00″W to 48°42′14″W) (Fig. 1). The area comprises about 125 km^2, in an elliptical shape (plateau), with side slopes that form natural walls (enclaves). The base of the mountain is bordered by farms and urban settlements (Carvalho & al. 2015, SEMAD 2021).

The mean altitude of the region is 1043 m a.s.l. and the climate is tropical (Aw) with dry winters and rainy summers according to Köppen-Geiger climate classification (Peel & al. 2007). Rains are concentrated from October to March, and the dry season is between April and September. The average annual temperature of the region is around 23 ℃, with a correspondence between the minimum average values (20 ℃) in the dry months and the

maximum average values (25 ℃) in the rainy months (Carvalho & al. 2015). The PESCAN is inserted in the Cerrado biome, which is characterized by the following landscapes: campo limpo, campo sujo, cerrado rupestre, enclaves of deciduous forest, veredas, gallery forest, mesophilic forest, trails, and savannas. Despite this rich vegetation landscape, most of the area is represented by savanna and grassland formations (Carvalho & al. 2015, SEMAD 2021).

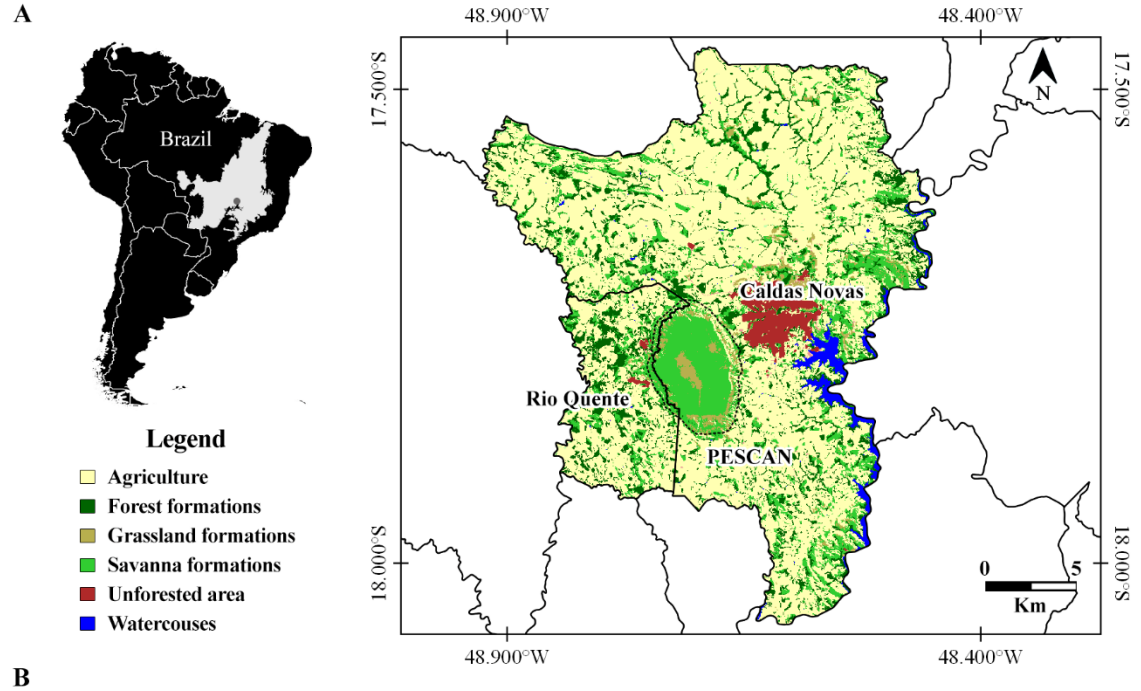

FIG. 1. A. Location of the Parque Estadual da Serra de Caldas Novas (dark grey dot) in the Brazilian Cerrado (light grey area), highlighting the use and land cover of the region. B. Some landscapes (savanna, forest, and grassland formations) from the sampling area. Use and land cover according to Souza & al. (2020).

Collection and identification of the material

To collect the material, we undertook 15 field expeditions over four years, within the limits of the PESCAN and its surroundings. The method of collection, preservation, and herborization followed the standard techniques for fungi (Neto & al. 2013). The taxonomic identification was performed by macro and microscopic analysis of the dried material and according to relevant identification keys (Hjortstam & Ryvarden 1980, Núñez & Ryvarden 2001, Ryvarden 2004, 2015, 2016, Groposo & al. 2007, Ţura & al. 2008, Abrahão & al. 2009, Chikowski & al. 2020, Gorjón 2020). Vouchers were deposited in the fungarium of the Universidade Estadual de Goiás (HUEG-Fungi) (Thiers 2022 [continuously updated]). All recorded taxa had their names were updated according to Index Fungorum (http://www.indexfungorum.org) and Mycobank (https://www.mycobank.org/) databases.

Results

We analyzed 192 samples that resulted in the identification of 51 species, six of which are new records from the Cerrado (Fig. 2), five from the Midwest region, and two for the State of Goiás. Considering the distribution in Brazil of the new occurrences for Cerrado, *Navisporus sulcatus* and *Trechispora mellina* were only known for the Atlantic Forest, *Flabellophora parva* for Atlantic Forest and Caatinga, while *Hymenochaete microcycla*, *Stiptophyllum erubescens,* and *Truncospora ohiensis* have a distribution known, so far, for the Amazonia and Atlantic Forest biomes.

Fig. 2. Species recorded for the first time from the Cerrado Biome. A–B. *Flabellophora parva*. C–D. *Hymenochaete microcycla*. E–F. *Navisporus sulcatus*. G–H. *Truncospora ohiensis*. I–J. *Stiptophyllum erubescens*. K. *Trechispora mellina.* Scale bars = 1 cm.

Species names are listed alphabetically in the checklist, including information on herbarium vouchers. An asterisk (*) indicates that the taxon is reported for the first time for Cerrado, two asterisks (**) new record for the Midwest region, and three asterisks (***) new record for the State of Goiás.

Checklist of species

Amauroderma aurantiacum (Torrend) Gibertoni & Bernicchia
Basionym: *Ganoderma aurantiacum* Torrend.
Description: Ryvarden (2004) as *A. macrosporum* J.S. Furtado.
Material examined HUEG: 9927, 9928, 9929, 9930, 9931, 9932, 9933, 9934, 10552, 10555, 10560, 10597, 10634, 10650, 14523, 14524, 14544.

Amauroderma exile (Berk.) Torrend
Basionym: *Polyporus exilis* Berk.
Description: Ryvarden (2004).
Material examined HUEG: 9935.

Coriolopsis floccosa (Jungh.) Ryvarden
Basionym: *Polyporus floccosus* Jungh.
Description: Ryvarden & Johansen (1980).
Material examined HUEG: 9909, 9910, 9911, 10783, 14526, 14551, 14558, 10566, 10567.

Cymatoderma caperatum (Berk. & Mont.) D.A. Reid
Basionym: *Polyporus caperatus* Berk.
Description: Welden (1960).
Material examined HUEG: 9921, 9922, 9923, 9924, 9925, 10579, 14510.

Daedalea ryvardeniana Drechsler-Santos & Robledo
Description: Drechsler-Santos & al. (2012).
Material examined HUEG: 10557, 10582, 10588, 10590, 10596, 14543, 14561.

Earliella scabrosa (Pers.) Gilb. & Ryvarden
Basionym: *Polyporus scabrosus* Pers.
Description: Ryvarden (2015).
Material examined HUEG: 9895, 10545.

Favolus brasiliensis (Fr.) Fr.
Basionym: *Daedalea brasiliensis* Fr.
Description: Ryvarden (2016) as *Polyporus tenuiculus* (Beauv.) Fr.
Material examined HUEG: 9895, 9886, 9887, 10598, 14507, 14520, 14522, 14527.

****Flabellophora parva*** Corner (Fig. 2).
Description: Ryvarden (2015).
Material examined HUEG: 10712, 14879.

Funalia caperata (Berk.) Zmitr. & Malysheva
Basionym: *Polyporus caperatus* Berk.
Description: Ryvarden & Johansen (1980).
Material examined HUEG: 9912, 9913, 9914, 14552, 10550, 10580.

Fuscoporia callimorpha (Lév.) Groposo, Log.-Leite & Góes-Neto
Basionym: *Polyporus callimorphus* Lév.
Description: Groposo & al. (2007).
Material examined HUEG: 9247, 9940, 10564, 10572.

Fuscoporia gilva (Schwein.) T. Wagner & M. Fisch.
Basionym: *Boletus gilvus* Schwein.
Description: Ryvarden (2004).
Material examined HUEG: 9942, 14540.

Gloeophyllum striatum (Fr.) Murrill
Basionym: *Daedalea striata* Fr.
Description: Núñez & Ryvarden (2001).
Material examined HUEG: 9955, 10546, 10578.

Gloeoporus thelephoroides (Hook.) G. Cunn.
Basionym: *Boletus thelephoroides* Hook.
Description: Ryvarden (2015).
Material examined HUEG: 9917, 9918, 9919, 9920.

Hexagonia hydnoides (Sw.) M. Fidalgo
Basionym: *Boletus hydnoides* Sw.
Description: Ryvarden (2015).
Material examined HUEG: 9906, 9907, 9908, 10554, 10593, 10586, 10601, 10790, 14542.

Hexagonia variegata Berk.
Description: Ryvarden (2015) as *H. papyracea* Berk.
Material examined HUEG: 9901, 9902, 9903, 9904, 10548, 10570, 10584, 10600, 10776, 14509, 14517, 14533, 14537, 14546, 14549, 14555.

Hymenochaete damicornis (Link) Lév.
Basionym: *Stereum damicorne* Link.
Description: Parmasto (2001).
Material examined HUEG: 9944, 9945, 9946, 9947, 9948, 9949, 9950.

****Hymenochaete microcycla*** (Zipp. ex Lév.) Spirin & Miettinen (Fig. 2).
Basionym: *Polyporus microcyclus* Zipp. ex Lév.
Description: Ryvarden & Johansen (1980).
Material examined HUEG: 14513, 14529.

Hymenochaete rheicolor (Mont.) Lév.
Basionym: *Stereum rheicolor* Mont.
Description: Parmasto (2001).
Material examined HUEG: 9951.

Lentinus berteroi (Fr.) Fr.
Basionym: *Agaricus berteroi* Fr.
Description: Ryvarden (2015).
Material examined HUEG: 10575, 10577, 14518.

Lentinus crinitus (L.) Fr.
Basionym: *Agaricus crinitus* L.
Description: Ryvarden (2015).
Material examined HUEG: 14456, 14514, 14521.

Lenzites elegans (Spreng.) Pat.
Basionym: *Daedalea elegans* Spreng.
Description: Núñez & Ryvarden (2001).
Material examined HUEG: 9896, 9897, 14545.

****Megasporia cavernulosa*** (Berk.) C.R.S. Lira & T.B. Gibertoni
Basionym: *Polyporus cavernulosus* Berk.
Description: Núñez & Ryvarden (2001) as *Dichomitus cavernulosus* (Berk.) Masuka & Ryvarden.
Material examined HUEG: 10589.

Metuloidea reniformis (Berk. & M.A. Curtis) Westphalen & Motato-Vásq.
Basionym: *Hydnum reniforme* Berk. & M.A. Curtis.
Description: Maas Geesteranus (1974).
Material examined HUEG: 9926.

Navisporus sulcatus (Lloyd) Ryvarden (Fig. 2).
Basionym: *Trametes sulcata* Lloyd.
Description: Ryvarden (2015).
Material examined HUEG: 9905.

Neodictyopus dictyopus (Mont.) Palacio, Robledo & Drechsler-Santos
Basionym: *Polyporus dictyopus* Mont.
Description: Ryvarden (2016).
Material examined HUEG: 9894, 14511, 14519, 14525, 14550, 14565.

****Pachykytospora alabamae*** (Berk. & Cooke) Ryvarden
Basionym: *Polyporus alabamae* Berk. & Cooke.
Description: Núñez & Ryvarden (2001).
Material examined HUEG: 14560.

Panus strigellus (Berk.) Overh.
Basionym: *Lentinus strigellus* Berk.
Description: Ryvarden (2015).
Material examined HUEG: 10573, 14541.

*****Perenniporia aurantiaca*** (A. David & Rajchenb.) Decock & Ryvarden
Basionym: *Pyrofomes aurantiacus* A. David & Rajchenb.
Description: Ryvarden (2016).
Material examined HUEG: 9916, 10738, 14880.

*****Phaeodaedalea incerta*** (Curr.) Ţura, Zmitr., Wasser & Spirin
Basionym: *Polyporus incertus* Curr.
Description: Ryvarden (2016) as *Trichaptum sprucei* (Berk.) Rajchenb. & Bianchin.
Material examined HUEG: 9954, 14515, 14562.

Phlebiopsis amethystea (Hjortstam & Ryvarden) R.S. Chikowski & C.R.S. Lira
Basionym: *Porostereum amethysteum* Hjortstam & Ryvarden.
Description: Hjortstam & Ryvarden (1990).
Material examined HUEG: 9915, 10587, 14557.

****Phylloporia chrysites*** (Berk.) Ryvarden
Basionym: *Polyporus chrysites* Berk.
Description: Ryvarden (2004).
Material examined HUEG: 14559.

Phylloporia* cf. *pectinata (Klotzsch) Ryvarden
Description: Ryvarden (2004).
Material examined HUEG: 10603.

****Phylloporia spathulata*** (Hook.) Ryvarden
Basionym: *Boletus spathulatus* Hook.
Description: Ryvarden (2004).
Material examined HUEG: 14532.

Polyporus guianensis Mont.
Description: Ryvarden (2016).
Material examined HUEG: 9889, 9890, 9891, 9892, 10602, 14535, 14548, 14553, 14594.

Polyporus leprieurii Mont.
Description: Ryvarden (2016).
Material examined HUEG: 9893, 14547, 10565, 10574.

Polyporus tricholoma Mont.
Description: Ryvarden (2016).
Material examined HUEG: 9489, 9888, 10780, 14534.

Pycnoporus sanguineus (L.) Murrill
Basionym: *Boletus sanguineus* L.
Description: Ryvarden (2016).
Material examined HUEG: 14508, 14536, 14538, 14539, 14554.

Schizophyllum commune Fr.
Description: Cooke (1961).
Material examined HUEG: 10562, 10592.

Schizophyllum umbrinum Berk.
Description: Cooke (1961).
Material examined HUEG: 10559, 10568, 14516.

Stereum hirsutum (Willd.) Pers.
Basionym: *Thelephora hirsuta* Willd.
Description: Ţura & al. (2008).
Material examined HUEG: 10583, 10591.

Stereum ostrea (Blume & T. Nees) Fr.
Basionym: *Thelephora ostrea* Blume & T. Nees.
Description: Chamuris (1988).
Material examined HUEG: 10553.

****Stiptophyllum erubescens*** (Berk.) Ryvarden (Fig. 2).
Basionym: *Daedalea erubescens* Berk.
Description: Ryvarden (2015) as *Gloeophyllum erubescens* (Berk.) Popoff.
Material examined HUEG: 14528.

Trametes pavonia (Hook.) Ryvarden
Basionym: *Boletus pavonius* Hook.
Description: Ryvarden (2016).
Material examined HUEG: 9898, 9899, 9900, 10571.

Trametes psila (Lloyd) Ryvarden
Basionym: *Fomes psila* Lloyd.
Description: Nogueira-Melo & al. (2012) as *Coriolopsis psila* (Lloyd) Ryvarden.
Material examined HUEG: 10778.

Trametes supermodesta Ryvarden & Iturr.
Description: Ryvarden (2016).
Material examined HUEG: 9884, 10563, 10605.

****Trechispora mellina*** (Bres.) K.H. Larss. (Fig. 2).
Basionym: *Corticium mellinum* Bres.
Description: Hjortstam & Ryvarden (1980).
Material examined HUEG: 14857.

*****Trichaptum biforme*** (Fr.) Ryvarden
Basionym: *Polyporus biformis* Fr.
Description: Ryvarden (2016).
Material examined HUEG: 9952.

Trichaptum perrottetii (Lév.) Ryvarden
Basionym: *Trametes perrottetii* Lév.
Description: Ryvarden (2016).
Material examined HUEG: 10779.

Trichaptum sector (Ehrenb.) Kreisel
Basionym: *Boletus sector* Ehrenb.
Description: Ryvarden (2016).
Material examined HUEG: 9953.

Trullella duracina (Pat.) Zmitr.
Basionym: *Leptoporus duracinus* Pat.
Description: Ryvarden (2015).
Material examined HUEG: 9936, 9937, 9938, 9939, 10547, 10556, 10671, 14531.

****Truncospora ohiensis*** (Berk.) Pilát (Fig. 2).
Basionym: *Trametes ohiensis* Berk.
Description: Núñez & Ryvarden (2001).
Material examined HUEG: 10549.

Conclusion

The PESCAN is a representative area of the Cerrado biome and has one of the richest landscapes in the region. The knowledge of the park biodiversity is currently focused on fauna and flora, while the funga is little known by the local and scientific community. Thus, we expect that the data on the diversity of corticioid and poroid fungi provided in this inventory will be relevant to mitigate the lack of local knowledge and raise awareness of the need to increase sampling efforts in the region and its importance as a significant reservoir of fungal biodiversity for the State of Goiás and Midwest Brazil.

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