New records of *Perenniporia sensu lato* and *Pyrofomes* for the Brazilian Cerrado

Diogo H. Costa-Rezende[1] , Valéria Ferreira-Lopes[1], Carlos A. Salvador-Montoya[1], Genivaldo Alves-Silva[1], Andrei Mello[2] & Elisandro Ricardo Drechsler-Santos[1]

[1] Universidade Federal de Santa Catarina, Department of Botany, Campus Trindade, CEP 88040-900, Florianópolis, Santa Catarina, Brazil. diogo_agrolab@hotmail.com
[2] Universidade de Cuiabá, Primavera do Leste, Jardim Riva, CEP 78850-971, Primavera do Leste, Mato Grosso, Brazil.

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ABSTRACT – During a survey of polypores in the National Park of Chapada dos Guimarães, Mato Grosso State, Brazil, specimens of *Perenniporia s. l.* and *Pyrofomes* Kotl. & Pouzar were collected. *Hornodermoporus martius* (Berk.) Teixeira, *Perenniporia aurantiaca* (A. David & Rajchenb.) Decock & Ryvarden, *P. tephropora* (Mont.) Ryvarden, *Pyrofomes lateritius* (Cooke) Ryvarden, and *Truncospora detrita* (Berk.) Decock are presented as new records for the Brazilian Cerrado biome. Illustrations, a brief description and discussion of each species, as well as an identification key are provided.

Key words**:** Polypores, *Polyporales*, taxonomy, xylophilous fungi

RESUMO – **Novos registros de *Perenniporia s. l.* e *Pyrofomes* para o Cerrado Brasileiro**. Durante expedições de coleta de políporos no Parque Nacional da Chapada dos Guimarães, estado de Mato Grosso, Brasil, foram coletados espécimes de *Perenniporia s. l.* e *Pyrofomes* Kotl. & Pouzar. *Hornodermoporus martius* (Berk.) Teixeira, *Perenniporia aurantiaca* (A. David & Rajchenb.) Decock & Ryvarden, *P. tephropora* (Mont.) Ryvarden, *Pyrofomes lateritius* (Cooke) Ryvarden e *Truncospora detrita* (Berk.) Decock são apresentados como novos registros para o bioma Cerrado. Ilustrações, uma breve descrição e discussão de cada espécie, bem como uma chave de identificação são apresentadas.

Palavras chave: fungos xilófilos, Políporos, *Polyporales*, taxonomia

INTRODUCTION

Perenniporia sensu lato encompasses white-rotting genera, such as *Abundisporus* Ryvarden, *Hornodermoporus* Teixeira, *Perenniporia sensu stricto*, *Perenniporiella* Decock & Ryvarden, *Truncospora* Pilát, and *Vanderbylia* D. A. Reid (Robledo *et al*. 2009, Zhao *et al*. 2013). *Perenniporia s. str.*, according to the type species, *P. medullapanis* (Jacq.) Donk, is characterized by annual to perennial basidiomes, a dimitic hyphal system, mainly with arboriform skeletal hyphae non dextrinoid and small, hyaline and apically truncate dextrinoid basidiospores (Decock & Stalpers 2006). *Abundisporus* differs mainly by presenting pale yellowish, non dextrinoid basiospores (Dai *et al*. 2002). *Hornodermoporus* is characterized by its large pileate basidiomata, strongly dextrinoid skeletal hyphae and amygdaliform, slightly truncate basidiospores (Teixeira 1994, Nuñez & Ryvarden 2001). *Perenniporiella* and *Vanderbylia* have pileate basidiomata and non-truncate basidiospores, differing mainly by its subglobose to globose, weakly dextrinoid basidiospores in *Perenniporiella* and amygdaliform and strongly dextrinoid basidiospores in *Vanderbylia* (Decock & Ryvarden 2003, Zhao *et al*. 2013). *Truncospora* is closely related to *Perenniporia s. str.*, differing mainly by its non-arboriform and variably branched skeletal hyphae (Decock 2011).

Pyrofomes Kotl. & Pouzar is characterized by presenting pileate reddish basidiomata with a dimitic to trimitic hyphal system and truncate basidiospores, occurring in live trees. It is closely related to *Perenniporia s. l*. and the color of the basidiomata is the main distinguishing feature between them (David & Rajchenberg 1985, Corner 1989, Ryvarden 1991, Spirin *et al*. 2005, Robledo *et al*. 2009, Zhao *et al*. 2013).

The placement of *Perenniporia s.l.* at family level remains unclear, being positioned in *Perenniporiaceae* Jülich, *Polyporaceae* Fr. *ex* Corda by Ryvarden (1991), and *Fomitopsidaceae* Jülich by Zmitrovich (2001). Recent molecular studies showed *Perenniporia* Murril as a polyphyletic group, supporting the smaller genera mentioned above (Robledo *et al*. 2009, Zhao *et al*. 2013). *Perenniporia s. l*. was also supported in a paraphyletic topology within the core polyporoid clade by Binder *et al*. (2013)

Perenniporia s. l. has a cosmopolitan distribution and comprises around 90 species (Zhao *et al*. 2013). In Brazil, three species of *Pyrofomes* and 18 of *Perenniporia s.l*. have been reported until now (Medeiros *et al*. 2012, Gugliotta *et al*. 2014). For the Cerrado region, only two species of *Perenniporia s. l*. were recorded (Gibertoni & Drechsler-Santos 2010, Abrahão *et al*. 2012).

The Cerrado is the largest savanna in the neotropics and is considered to be a *Hotspot* of biodiversity, comprising particular flora and fauna (Aguiar & Camargo 2004, Felfilli *et al.* 2000). In this context, the knowledge on fungal diversity, particularly of wood-rotting fungi, is certainly unexplored.

During a survey of polypores in the Chapada dos Guimarães National Park, state of Mato Grosso (Brazil), specimens of *Perenniporia s.l.* and *Pyrofomes* were collected and we present new records for the Brazilian Cerrado biome.

MATERIAL AND METHODS

Samples were collected in the Chapada dos Guimarães National Park (15°10'S-15°30'S and 55°45' W-56°00'W), Mato Grosso State (Brazil), inserted in the Cerrado biome. According to the Köppen climate classification, the climate is Aw and Cw, both characterized by being hot and humid, with defined rainy (October to March) and dry (April to September) seasons (Pires & Mota 2009). Collections were carried out in 2011 and samples were processed according to Lodge *et al*. (2004). Macro- and microscopical analyses of basidiomata and abbreviations follow Decock *et al*. (2010). Specimens studied are preserved at the FLOR herbarium. Reference material of *Pyrofomes lateritius* (NY 00730765, type), *Perenniporia martia* (Berk.) Ryvarden [K(M): 33762, type] and *Perenniporia tephropora* (Mont.) Ryvarden (HUEFS 133921) were used for morphological comparison. Herbarium acronyms follow Thiers B. [continuously updated].

RESULTS AND DISCUSSION

Specimens of *Hornodermoporus martius* (Berk.) Teixeira, *Perenniporia tephropora* (Mont.) Ryvarden, *Pe. aurantiaca* (A. David & Rajchenb.) Decock & Ryvarden, *Pyrofomes lateritius* (Cooke) Ryvarden and *Truncospora detrita* (Berk.) Decock were collected and morphologically revised. Illustrations, a brief description, a taxonomic discussion, a key of *Perenniporia s.l*. as well as *Pyrofomes*, which occurs in Cerrado biome, are presented.

Hornodermoporus martius (Berk.) Teixeira

(Figs. 1, 2, 10, 13,14)

Basidiome perennial, pileate, pendant, 10.0 × 11.0 × 4.0 cm, woody-hard; pileus surface dull, glabrous, concentrically sulcate, radially cracked, rimose, dark brown; margin entire, obtuse; pore surface white to cream colored; *pores* circular, regular, (100-)130-200 µm wide, 3-5 p/mm; dissepiments thin, entire, 40-90(-150) µm thick; *tubes* distinctly stratified, concolorous with the pore surface, 3.0 cm deep; context dull, homogeneous, white to sordid. Hyphal system dimitic in the context and the tubes, generative hyphae hyaline, clamped, thin-walled, skeletal hyphae abundant, dominating in the whole basidiome, up to 1250 µm long and 4 µm wide, unbranched, thick-walled to almost solid, ending in thin-walled rounded tips, often with secondary septa, strongly dextrinoid, in the trama of tubes with some hyphae turn into biding-like hyphae, few branched and short, as aborted skeletal, tortuous, thick-walled; cystidia absent; basidia not observed; basidiospores amygdaliform, (5-)6-8 × 4-4.5(-5) µm, 6.8 × 4.1 µm on average, smooth, thick-walled, hyaline, dextrinoid.

Remarks: The amygdaliform shape of the basidiospores is distinctive for this species (Gerber

et al. 1999, Nuñez & Ryvarden 2001). The presence of an apically encrusted cystidia was reported by Ryvarden & Johansen (1980) and Núñez & Ryvarden (2001). However, it was not observed in the specimens studied here and were not cited by Teixeira (1994) and Gerber *et al*. (1999) in their descriptions. Future studies should take into account the significance of this character in the taxonomy of this taxon. In this study we adopted the generic sense of Teixeira (1994), which has recently been corroborated by molecular analyses (Robledo *et al*. 2009, Zhao *et al*. 2013). *Hornodermoporus* is mainly characterized by large pileate basidiomata, strongly dextrinoid skeletal hyphae and thick walled amygdaliform basidiospores.

Distribution: Pantropical (Núñez & Ryvarden 2001, as *Perenniporia martia*). In Brazil, this species is widely distributed, being recorded in the Amazon region, Atlantic Rain Forest and Pantanal biomes (Gerber *et al*. 1999, as *P. martius*, Bononi *et al*. 2008, as *P. martii,* Medeiros *et al*. 2012, Gugliotta *et al*. 2014, as *P. martia*).

Examined material: BRAZIL, AMAZONAS, São Jerônimo, *sine datum*, R. Spruce [K(M) 33762 type]. *Ibidem*, MATO GROSSO, Chapada dos Guimarães, Chapada dos Guimarães National Park, Sítio Véu da Noiva, in dead trunk on soil, 12.VI.2011, V. Ferreira-Lopes 27 (FLOR).

Perenniporia aurantiaca (A. David & Rajchenb.) Decock & Ryvarden

(Figs. 3, 9, 12)

Basidiome seasonal, resupinate, 11.0 × 2.5 cm; pore surface yellowish to pale brownish orange; pores circular to angular, 100-130(-140) µm wide, irregular, (6-)7-9 p/mm; dissepiments thin, entire, 20-50(-70) µm thick; tubes non-stratified, concolor with the pore surface; context thin, almost absent, homogeneous pale orange. Hyphal system dimitic, generative hyphae clamped, thin-walled to slightly thick-walled, hyaline, ending at the pore as dendrohyphidia-like, in the context and tubes with small arboriform skeletal hyphae, straight to tortuous, or geniculate, up to 100 µm long and 3 µm wide, few to moderately branched, ending in thin-walled rounded tips, often with four secondary septa, narrow, branched, binding-like hyphae, non-dextrinoid; cystidia absent; basidia clavate to pear-shaped, four sterigmata, 11-15 × 7-9 µm; basidiospores ellipsoid, (4-)5-6 × 2-4 µm, 5.2 × 3.1 µm on average, smooth, truncate, thick-walled, apiculous and germ pore conspicuous or difficult to observe, hyaline, IKI- to slightly dextrinoid.

Remarks: *Perenniporia xantha* Decock & Ryvarden is morphologically related to *P. aurantiaca*, differing basically by its yellowish pore surface. Our specimen presents a yellowish to pale brownish orange pore surface, causing the separation from *P. xantha* difficult. The material treated here presents dendrohyphidia, a feature observed by Decock & Ryvarden (1999a) in *P. aurantiaca*, not referred for *P. xantha*. However, this character is questionable, since it often collapses upon drying. A polyphasic analysis (molecular, ecological and morphological) with the specimens identified as *P. aurantiaca* from Brazil and the material studied by Decock & Ryvarden (1999a) may improve the delimitation of these closely related taxa.

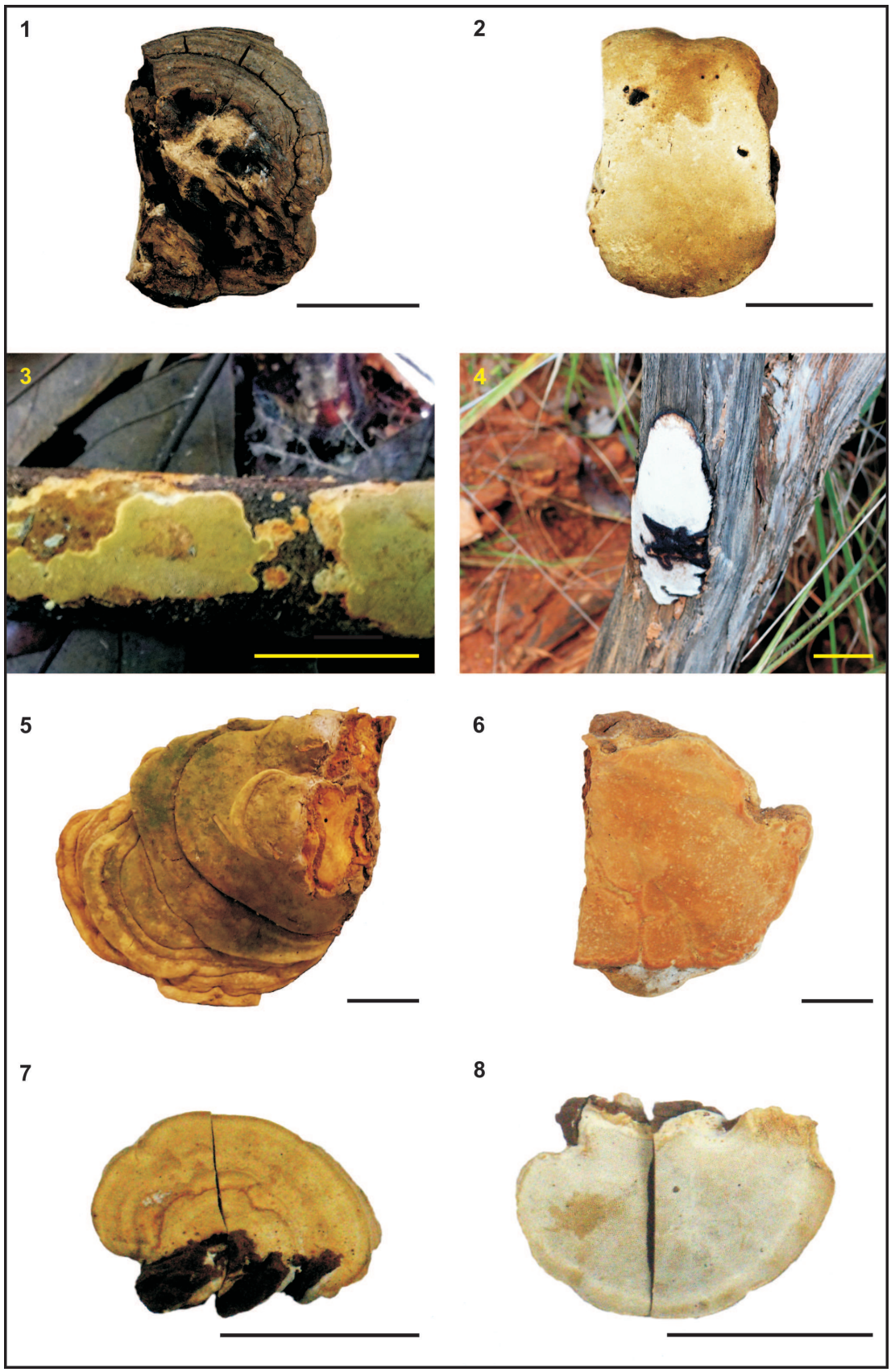
Distribution: Neotropical (Decock & Ryvarden 1999a). In Brazil this species has been recorded for the Amazon region, Atlantic Rain Forest and Caatinga biomes (Gibertoni *et al*. 2004, Gomes-Silva & Gibertoni 2009, Medeiros *et al*. 2012, Drechsler-Santos *et al*. 2013a, Gugliotta *et al*. 2014).

Examined material: BRASIL, MATO GROSSO, Chapada dos Guimarães, Chapada dos Guimarães National Park, Sítio Rio Claro, in dead branch on soil, 07.I.2013, G. Alves-Silva 334 (FLOR).

Perenniporia tephropora (Mont.) Ryvarden

(Figs. 4, 17, 18)

Basidiome perennial, resupinate, 12.0 × 4.0 cm, woody-hard; margin blackish; pore surface pale to dark grayish; pores circular to angular, elongated, (140-)150-200 µm wide, (4-)5-6 p/mm; dissepiments thin, entire, (30-)40-80(-90) µm thick; *tubes* distinctly stratified, slightly darker than the pore surface, 0.3 cm deep; context thin, homogeneous, grayish brown. Hyphal system dimitic in the context and tubes, generative hyphae thin-walled, clamped, hyaline, skeletal hyphae abundant, up to 324 µm long and 3.5 µm wide, slightly branched, thick-walled to almost solid, ending in thin-walled rounded tips, often with four secondary septa, some hyphae turn into biding-like hyphae, non- to variably dextrinoid; cystidia absent; cystidioles mamilate to ampuliform, 15-20 µm length, not abundant; basidia not observed; basidiospores ellipsoid, 5-6 × (3.5-)4-5 µm, 5.8 × 4.7 µm on average, smooth, truncate at the apex,



Figs. 1-8. 1, 2. *Hornodermoporus martius* VFL 27 (FLOR); **1.** Pilear surface; **2.** Hymenophore; **3.** *Perenniporia auratiaca* GAS 334 (FLOR). **4.** *Perennipporia tephropora* DS 1052 (FLOR). **5, 6.** *Pyrofomes lateritius* GAS 244 (FLOR). **5.** Pilear surface; **6.** Hymenophore; **7, 8.** *Truncospora detrita* GAS 335 (FLOR); **7.** Pilear surface; **8.** Hymenophore. Bars: **Figs. 1, 2**= 5 cm; **Figs. 3-8**= 2 cm.

apiculus difficult to observe, thick-walled, with or without germ pore, hyaline, variably dextrinoid.

Remarks: The grayish to dark ochraceous pore surface is a diagnostic feature to identify this species (Drechsler-Santos *et al*. 2013b). This species is usually described as presenting large resupinate basidiomata with an effused-reflexed dark portion (Ryvarden & Johansen 1980, Núñez & Ryvarden 2001, Gerber *et al*. 1999, Drechsler-Santos *et al*. 2013b); however, our collection is totally resupinate. Ryvarden & Johansen (1980) combined this taxon into the genus *Loweporus* Wright, due to its dark basidiomata. However, Zhao *et al*. (2013) show that the species is related to *Perenniporia s. str*. clade, further phylogenetic and morphological studies of this broadly distributed taxon may improve its generic and specific delimitation.
Distribution: Pantropical (Gilbertson & Ryvarden 1987). In Brazil, this species has been recorded for the Amazon region and Atlantic Rain Forest biomes (Gerber *et al*. 1999, Medeiros *et al*. 2012, Gugliotta *et al*. 2014).

Examined material: BRASIL, BAHIA, Paulo Afonso, under dead trunk, 17.X.2006, J.R.T. Vasconcellos-Neto 238 (HUEFS 133921). MATO GROSSO, Chapada dos Guimarães, Chapada dos Guimarães National Park, Sítio Véu da Noiva, in dead trunk, 23.III.2013, E. R. Drechsler-Santos DS1052 (FLOR).

Pyrofomes lateritius (Mont.) Ryvarden

(Figs. 5, 6, 11, 15, 16)

Basidiome perennial, pileate broadly attached, aplannate to almost triquetrous with umbo, solitary to concrescent, 11.0 × 9.0 × 4.0 cm, woody-hard; pileus surface dull, slightly tomentose in young basidiomes turning to glabrous with age, concentrically sulcate, brownish orange to ochraceous towards the margin; margin obtuse, entire to lobed; pore surface pale brown to brick orange, pores circular, regular, 60-130(-140) µm wide, 5-7 p/mm; dissepiment entire, 20-90(-100) µm thick; tubes distinctly stratified, paler than pore surface, 0.5-2.0 cm deep; context thick, homogeneous, fibrous, vivid brick orange. Hyphal system dimitic in the context and tubes, generative hyphae thin-walled, clamped, hyaline, skeletal hyphae abundant, up to 1065 µm long and 5 µm wide, smaller in the tubes (up to 192 µm long and 3 µm wide), slightly branched, thick-walled, ending in thin-walled rounded tips, often with five secondary septa, in the trama of tubes with some hyphae turn into biding-like hyphae, with few branches and short, as aborted skeletal, tortuous, thick-walled, non-dextrinoid; cystidia absent; basidia not observed; basidiospores ellipsoid, 4-5 × 3-4(-4.5) µm, 4.8 × 3.7 µm on average, smooth, truncate at the apex, with or without apiculus, thick-walled, germ pore present, hyaline to pale yellow, IKI-.

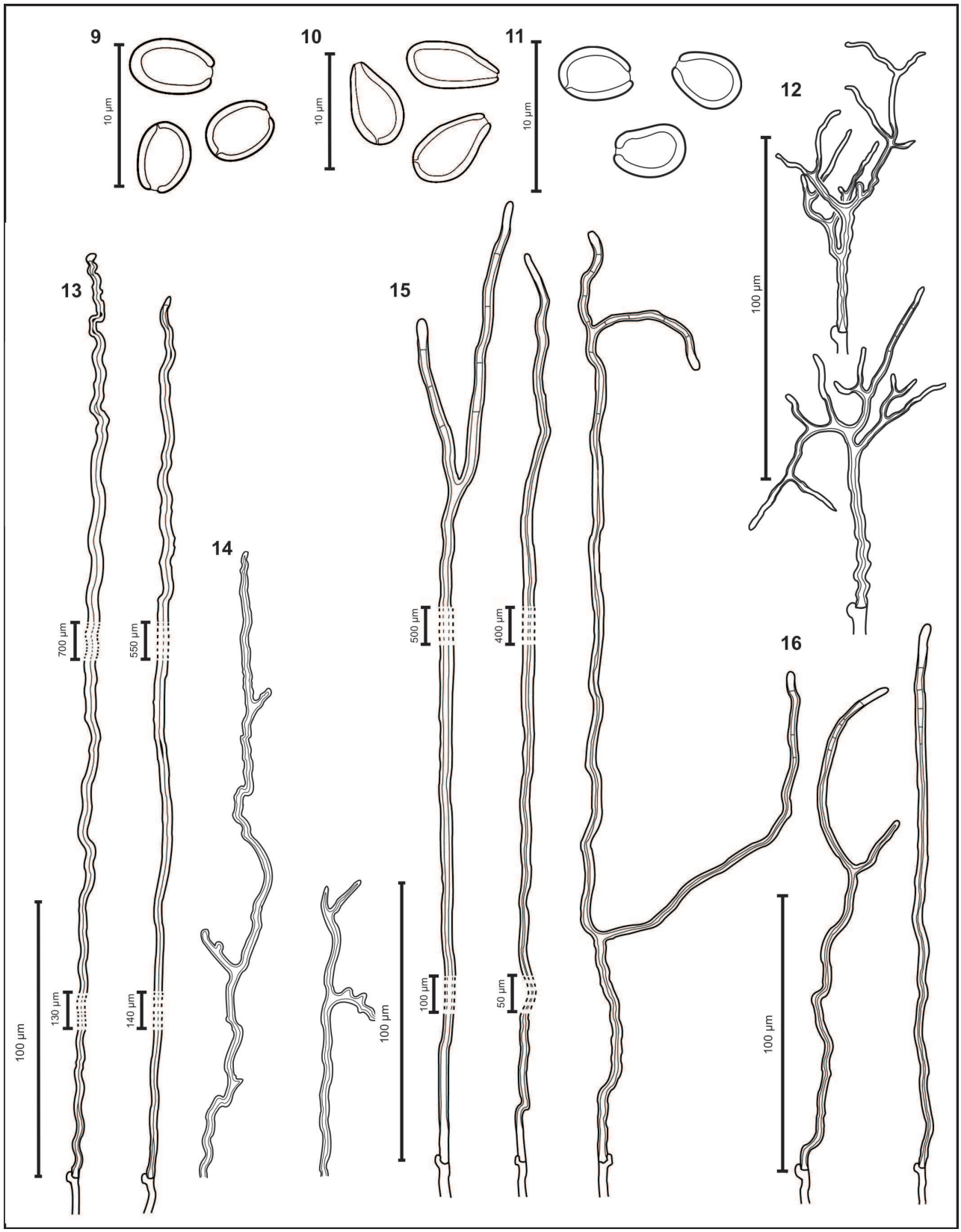
Remarks: *Pyrofomes perlevis* (Lloyd) Ryvarden is almost identical species, differing by having larger pores (2-3 per mm) (Wright *et al*. 1996). Our specimens present smaller basidiospores than the *P. lateritius* type specimen (NY 730765) and BAFC 33072 (Wright *et al*., 1996) [(4.5-)5-6(-6.5) × 3-5 µm and 5.2-6.7 × 4-5.4 µm, respectively]. In this work we choose to consider a broader variation about this feature. Further studies, including ecological and phylogenetic features, may point this taxon as a taxonomic complex.
Distribution: Argentina and Brazil (Ryvarden, 1988; Wright *et al*., 1996). In Brazil this species has been recorded for the Amazon region and the Atlantic Rain Forest biomes (Baltazar & Gibertoni 2009, Gomes-Silva & Gibertoni 2009, Gugliotta *et al*. 2014).

Examined material: BRASIL, RIO DE JANEIRO, *sine datum* (NY00730765 type). *Ibidem*, MATO GROSSO, Chapada dos Guimarães, Chapada dos Guimarães National Park, Sítio Véu da Noiva, on living undetermined angiosperm, 05.VIII.2012, G. Alves-Silva 244 (FLOR). *Ibidem,* on unknown substrata, 10.III.2013, G. Alves-Silva 409 (FLOR).

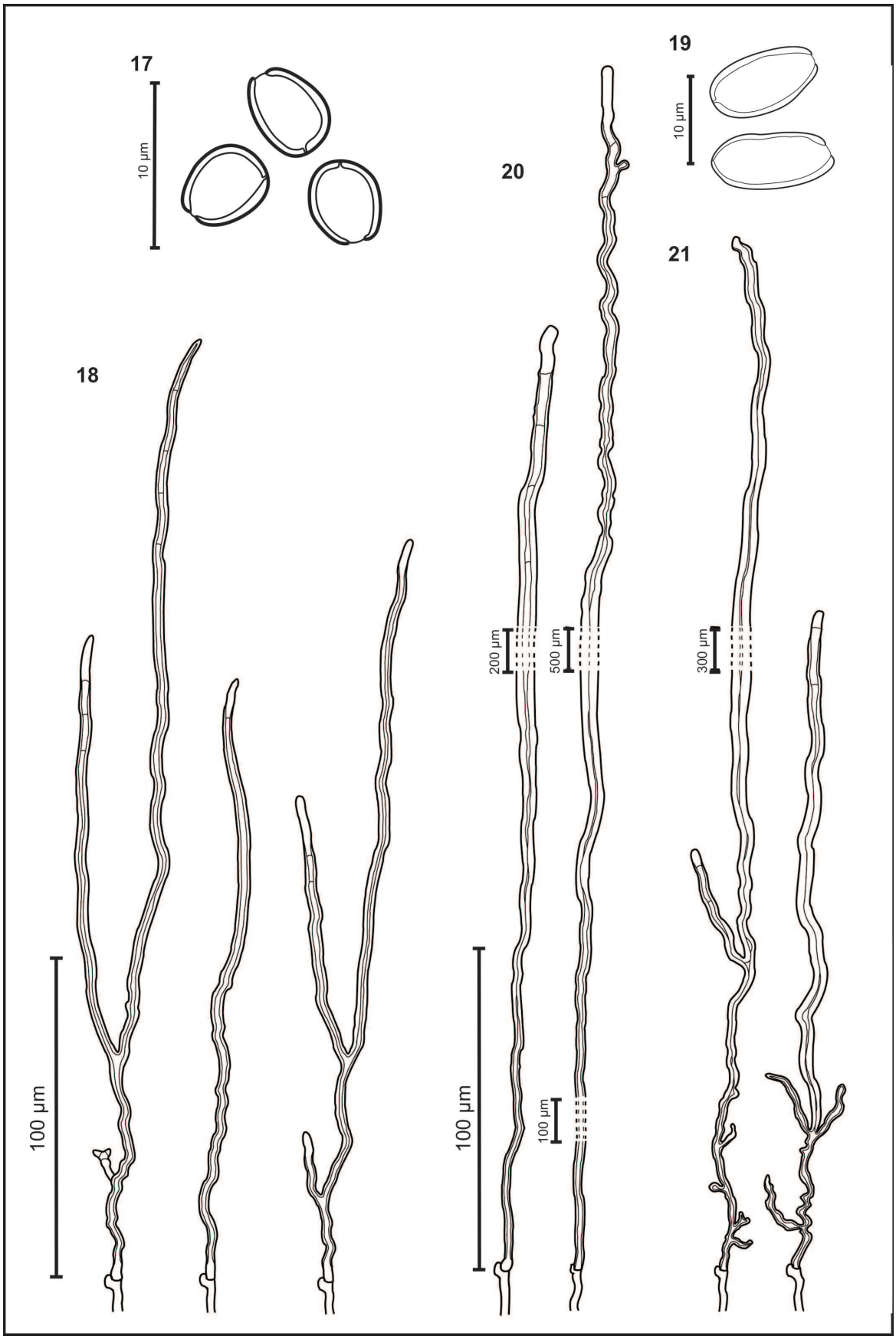
Truncospora detrita (Berk.) Decock

(Figs. 7, 8, 19-21)

Basidiome pileate, solitary, dimidiate, applanate to subtriquetrous, fan-shaped, 2.0 × 3.0 × 0.9 cm, corky; pileus surface dull, glabrous to slightly tomentose, slightly concentrically sulcate, cream colored; *margin* entire, round; pore surface white to pale brown near the margin; *pores* circular, regular, (130-)140-180(-200) µm, (3-)5-6 p/mm; dissepiment entire, thick, 50-110(-120) µm thick; tubes indistinctly stratified, slightly darker than the pore surface, 0.6 cm deep; context dull, thick, homogeneous, corky, concolorous with tube layer. Hyphal system dimitic in context and tubes, generative hyphae branched, clamped, thin-walled, hyaline, skeletal hyphae dominant in the context, arising from clamps, up to 1250 µm long and 4 µm wide, unbranched in the trama of tubes unbranched



Figs. 9-16. 9, 12. *Perenniporia aurantiaca* GAS 334 (FLOR); **9.** Basidiospores; **12.** Skeletal hyphae of context and tubes; **10, 13, 14.** *Hornodermoporus martius* VFL 27 (FLOR), **10.** Basidiospores; **13.** Skeletal hyphae in the context; **14.** Biding-like hyphae in the tubes; **11, 15,16.** *Pyrofomes lateritius* GAS 244 (FLOR); **11.** Basidiospores; **15.** Skeletal hyphae in the context; **16.** Skeletal hyphae in the tubes.



Figs. 17-21. 17, 18. *Perennipporia tephropora* DS 1052 (FLOR); **17.** Basidiospores; **18.** Skeletal hyphae of context and tubes; **19-21.** *Truncospora detrita* GAS 335 (FLOR); **19.** Basidiospores; **20.** Skeletal hyphae of context; **21.** Skeletal hyphae of tubes.

to slightly branched skeletal hyphae, tortuous, thick-walled to almost solid, ending in thin-walled rounded tips, often with four secondary septa, variably weakly dextrinoid, and some hyphae turn into binding-like hyphae, with few branches and short, lateral or terminal processes, as aborted skeletal, tortuous, thick-walled; *cystidia* absent; *basidia* not observed; *basidiospores* ellipsoid to elongated, (8-)9-13(-14) × 4-8 µm, 10.9 × 6.4 µm on average, smooth, truncate at the apex, apiculus small, thick-walled, with germ pore, hyaline, dextrinoid.

Remarks: The combination of pileate basidiomes, dimitic (to trimitic) hyphal system with dextrinoid skeletal hyphae and basidiospore shape, characterizes this species (Decock & Ryvarden 1999b). *Truncospora detrita* is very similar to *T. ochroleuca* (Berk) Pilát and *T. ohiensis* (Berk) Pilát, which has also been recorded for Brazil. The spores of *T. ochroleuca* are larger [(12-)14-17(-18) × 7.0-9.5 µm] and *T. ohiensis*, although presenting similar micromorphology, differs mostly by smaller basidiomes and its distribution is probably restricted to the northern hemisphere. Furthermore, the type specimen of *P. detrita* is from Brazil and this taxon is probably endemic to the neotropical rainforests (Decock 2011).

Distribution: Probably endemic to neotropical rainforests (Decock 2011). In Brazil this species has been recorded in the Amazon region and in the Atlantic Rain Forest biomes (Medeiros *et al*. 2012, Ryvarden & Meijer 2002, Gugliotta *et al*. 2014).

Examined material: BRASIL, MATO GROSSO, Chapada dos Guimarães, Chapada dos Guimarães National Park, Sítio Rio Claro, in dead branch on the soil, 07.I.2013, G. Alves-Silva 335 (FLOR).

Key to species of *Pyrofomes* and *Perenniporia s. l.* recorded from Brazillian Cerrado

1 Context, tubes and pore surface orange……..……...……... 2

1' Context, tubes and pore surface different colored ...……..…. 3

2 Basidiome pileate..... *Pyrofomes lateritius*

2' Basidiome resupinate..... *Perenniporia aurantiaca*

3 Basidiome distinctly pileate..... 4

3' Basidiome resupinate to effuse-reflexed…….……...……. 6

4 Basidiome wood hard, upper surface dark brown to almost black, amydagliform basidiospores ……..……..……..… *Hornodermoporus martius*

4' Basidiome corky, upper surface creamy to reddish brown, basidiospores distinctly truncate……...5

5 Basidiospores up to 14 µm in length……...……..… *Truncospora detrita*

5' Basidiospores larger than 14 µm in length…..……....…….……. *T. ochroleuca*

6 Margin blackish, pore surface grayish……...…. *P. tephropora*

6' Margin white to cream, pore surface whitish…….....….. *P. medullapanis*

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