UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL
INSTITUTO DE BIOCIÊNCIAS
DEPARTAMENTO DE BOTÂNICA

TESE DE DOUTORADO

TAXONOMIA E FILOGENIA DE *FOMITIPORIA* (HYMENOCHAETALES, BASIDIOMYCOTA) NO BRASIL

GENIVALDO ALVES DA SILVA

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Tese apresentada ao Programa de Pós-Graduação em Botânica, Área de Sistemática, Evolução e Ecologia de Algas, Plantas e Fungos, da Universidade Federal do Rio Grande do Sul (UFRGS), como requisito parcial para a obtenção do título de Doutor em Ciências (Botânica).

Orientadora **Dra. Rosa Mara Borges da Silveira** - Universidade Federal do Rio Grande do Sul.

Coorientador **Dr. Elisandro Ricardo Drechsler dos Santos** - Universidade Federal de Santa Catarina.

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RESUMO

Fomitiporia é um gênero que reúne espécies de fungos caracterizadas por apresentar basidiomas perenes, pileados a ressupinados, basidiósporos hialinos, dextrinoides e cianófilos, sistema hifal dimítico e presença de setas himeniais em algumas espécies. A baixa variação morfológica é uma das características predominantes entre as espécies classificadas em *Fomitiporia*. As linhagens, de modo geral, parecem apresentar algum grau de especificidade fungo-hospedeiro (de exclusividade ou recorrência) e de distribuição geográfica, mas também há casos de espécies generalistas e amplamente distribuídas. No entanto, como reflexo do uso exclusivo de uma abordagem unicamente morfológica, muitas espécies do gênero foram consideradas com uma amplitude morfológica e geográfica maior do que se tem constatado quando empregada uma abordagem integrativa (dados moleculares e ecológicos somados aos morfológicos). Por consequência, uma desconhecida diversidade representada por diferentes linhagens vem sendo revelada. No Brasil, *F. robusta* e *F. punctata*, espécies da Eurásia, foram dois nomes comumente empregados para espécimes com basidiomas pileados e ressupinados, respectivamente. Além destas, no Brasil são conhecidas *F. apiahyna*, *F. atlantica*, *F. bambusarum*, *F. dryophila*, *F. maxonii*, *F. neotropica*, *F. sanctichampagnatii*, *F. spinescens* e *F. subtilissima*, muitas não testadas filogeneticamente. Com o intuito de reconhecer a diversidade de espécies de *Fomitiporia* que ocorrem no Brasil e entender suas relações filogenéticas e delimitações, foi realizado grande esforço de coleta na Amazônia, Caatinga, Cerrado, Mata Atlântica e Pampa, além de revisão de coleções de herbários, totalizando 314 espécimes analisados morfologicamente, dos quais cerca de 60 foram acessados filogeneticamente (moleculares: nrITS, nrLSU, *TEF1*-α e *RPB2*). Todos os espécimes coletados no Brasil foram agrupados filogeneticamente em um único clado (neotropical), composto por ao menos sete clados menores e 14 linhagens propostas como espécie ou combinação novas: clado **(1) *F. texana*** [*F. rhizophila* ad int. sp. nov.]; **(2) *F. langloisii–F. castilloi*** [*F. bambusipileata* sp. nov., *F. elliptica* ad int. sp. nov., *F. exigua* ad int. sp. nov., *F. pulvinata* ad int. sp. nov. e *F. rondoni* ad int. sp. nov.]; **(3) *F. elegans*, (4) Andino, (5) *F. biformis*** ad int. [*F. biformis* ad int. sp. nov.], (**6) *F. atlantica–F. subtilissima*** [*F. puiggarii* ad int. sp. nov.] e (**7) *F. apiahyna sensu lato*** [*F. conyana* sp. nov., *F. elegans* comb. nov., *F. melanoderma* ad int. sp. nov., *F. murrilli* sp. nov., *F. nubicola* sp.

nov. e *F. prolongata* ad int. sp. nov.]. Dessa forma, a diversidade do gênero no Brasil foi ampliada de oito para 23 espécies, com *F. punctata*, *F. robusta* e *F. dryophila* confirmadas como ausentes e *F. castilloi* e *F. impercepta* registradas pela primeira vez. Uma chave dicotômica é apresentada, bem como as diferenças morfológicas, principalmente nos grupos com baixa variação nos estados de caractere, foram cuidadosamente alinhadas aos dados ecológicos de hospedeiro e distribuição, os quais somados às análises filogenéticas auxiliaram no reconhecimento de uma diversidade críptica.

PALAVRAS-CHAVE: Agaricomycetes, *Phellinus s. lat*., Funga, fungos neotropicais, fungos poliporoides, análises filogenéticas moleculares, espécies crípticas, complexos morfológicos, Amazônia, Mata Atlântica, Cerrado, Pampa.

ABSTRACT

Fomitiporia is characterized by having perennial, pileate to resupinate basidiomata; hyaline, dextrinoid, cyanophilous, globose to subglobose basidiospores; dimitic hyphal system and hymenial setae variable present. The genus is also characterized by presenting few morphological variations within its species. Among *Fomitiporia* species there are both fungal host-exclusivity or host-recurrence with restricted geographic distribution as well as generalists and widely distributed. Based on only morphological approach the species were recognized with wider morphological concepts and broader distribution. However, an integrative taxonomy (morphological, molecular, and ecological data) has been evidencing more restricted morphological concepts and geographic distributions. Thereby, from more detailed approach, a hidden diversity has been revealed. In Brazil, *F. robusta* e *F. punctata*, Eurasian species, were frequently misaddressed to pileate and resupinate species, respectively. In addition, also were reported *F. apiahyna*, *F. atlantica*, *F. bambusarum*, *F. dryophila*, *F. maxonii*, *F. neotropica*, *F. sanctichampagnatii*, *F. spinescens* e *F. subtilissima*, with most of them lacking phylogenetic analysis. In order to understand *Fomitiporia* species diversity in Brazil, their phylogenetic relationships, and boundaries, specimens collected in extensive field expeditions in Amazon, Caatinga, Cerrado, Atlantic Forest, and Pampa, and herbarium specimens (n = 314) were morphologically analyzed and about 60 included in the multilocus phylogenies (nrITS, nrLSU, *TEF1*-α, and *RPB2*). All specimens included in the phylogenetic analysis were recovered in single clade (neotropical), which is subdivided in at least seven minor clades and 14 lineages were here proposed as new species or combinations: **(1) *F. texana* clade** [*F. rhizophila* ad int. sp. nov.]; **(2) *F. langloisii–F. castilloi* clade** [*F. bambusipileata* sp. nov., *F. elliptica* ad int. sp. nov., *F. exigua* ad int. sp. nov., *F. pulvinata* ad int. sp. nov., and *F. rondoni* ad int. sp. nov.]; **(3) *F. elegans* clade** [*F. elegans* comb. nov.]**, (4) Andino clade, (5) *F. biformis*** ad int. **clade** [*F. biformis* ad int. sp. nov.], (**6) *F. atlantica–F. subtilissima* clade** [*F. puiggarii* ad int. sp. nov.], and (7**) *F. apiahyna sensu lato* clade** [*F. conyana* sp. nov., *F. melanoderma* ad int. sp. nov., *F. murrilli* sp. nov., *F. nubicola* sp. nov., and *F. prolongata* ad int. sp. nov.]. Thus, the diversity of *Fomitiporia* species in Brazil increased to 23, while *F. dryophila*, *F. punctata*, and *F. robusta* were confirmed as absent and *F. castilloi* and *F. impercepta* are new records for the country. A neotropical species dichotomic key is provided. Furthermore, morphological analyses were carefully aligned to ecological data (fungal-host relationships and geographic distribution) and molecular phylogenies to understand cryptic species with poor morphological variation and this demonstrated being crucial on species boundaries sharpening.

KEY WORDS: Agaricomycetes, *Phellinus s. lat.*, Funga, neotropical fungi, polypores, molecular phylogenetic analyses, cryptic species, morphological complexes, Amazônia, Mata Atlântica, Cerrado, Pampa

SUMÁRIO

1. INTRODUÇÃO GERAL

Os fungos são um dos grupos de organismos cruciais à manutenção da vida na biosfera como a conhecemos. Onde quer que você imagine, lá estão esses seres vivos heterotróficos. Através da digestão extracelular e em sua grande maioria formados por compartimentos celulares filamentosos, eles são capazes de obter os componentes mínimos a sua bioestrutura e funções fisiológicas mesmo em ambientes extremamente distróficos. Tanto local como globalmente, eles são obrigatórios nos ecossistemas minimamente complexos. São responsáveis por participar dos diversos ciclos biogeoquímicos, a exemplo os lignocelulolíticos, essenciais a reciclagem de matéria orgânica vegetal (Watkinson *et al.*, 2015; Willis, 2018).

Ao mesmo tempo que há espécies intimamente relacionadas com ambientes e/ou organismos, ou seja, com um nicho específico e especializado, há muitas outras abrangentes e oportunistas, como também aquelas flexíveis, com uma grande plasticidade, respondendo conforme estímulos bióticos e abióticos. (Boddy & Hiscox, 2017; Selosse *et al.*, 2018; Zanne *et al.*, 2019). Apesar de toda essa importância e suas múltiplas funções conhecidas (ou nem tanto assim), pouco sabemos desse reino. Das mais de 3 milhões de espécies que se estimam existir, menos que 5 % foram descritas (Blackwell, 2011; Hawksworth & Lücking, 2017). Nos últimos 10 anos tem se investido substancialmente no estudo dos fungos, tal como os estudos evolutivos que têm descoberto quais foram os eventos que moldaram o padrão de diversidade que observamos hoje, como a imensa variabilidade e diversidade existente, tal como as intrigantes convergências evolutivas dos fenótipos morfológicos (Sánchez-García & Matheny, 2017; Sánchez-Ramírez *et al.*, 2015; Varga *et al.*, 2019), que foram por um longo tempo a principal fonte de informação para a classificação das espécies.

Dentre os diversos grupos de fungos existem aqueles que classificamos artificialmente como macrofungos, ou seja, espécies cujas estruturas reprodutivas são facilmente observadas a olho nu. Esses macrofungos são classificados nos dois grandes filos conhecidos atualmente, Ascomycota Caval.-Sm. e Basidiomycota R.T. Moore, sendo suas estruturas reprodutivas nomeadas de ascoma (ou estroma com vários ascomas) e basidioma. Em Basidiomycota são em sua maioria da classe Agaricomycetes Doweld, no qual dois grandes grupos morfológicos são seus mais evidentes e conhecidos representantes. São eles os fungos agaricoides, os clássicos fungos conhecidos como cogumelos, com um “chapéu” sustentado por uma “haste” e os fungos poliporoides, popularmente conhecidos como “orelhas de pau”, sendo sua principal característica a presença de poros (projeções dos tubos) na porção inferior do basidioma. No entanto, evidências de filogenias moleculares envolvendo as principais ordens de Agaricomycetes mostram que esses e outros agrupamentos morfológicos (ex.: corticioides, gasteroides) são encontradas proximamente relacionadas em diferentes linhagens *(*ex.: Hibbett, 2006; Larsson *et al.*, 2006; Matheny *et al.*, 2006).

Dentre as ordens de Agaricomycetes está Hymenochaetales Oberw., representada em sua grande maioria de fungos degradadores de madeira, sendo pouquíssimas as espécies causadoras de podridão marrom, estas que durante o processo de degradação mantêm a lignina, diferente daquelas que causam podridão branca, conhecidas como lignocelulolíticas. Porém, tanto fungos micorrízicos como alguns que utilizam nematoides como fonte de nitrogênio e outros que se associam com musgos e algas unicelulares também são filogeneticamente próximos. Apesar da aparente ausência de sinapomorfia em Hymenochaetales, a grande maioria das linhagens apresentam dolíporo com parenstossoma não perfurado (Larsson *et al.*, 2006).

Dentre os organismos classificados nessa ordem, há um grande grupo em seu core, a família Hymenochaetaceae Donk, na qual as espécies são caracterizadas principalmente pelo escurecimento permanente das hifas quando em contato com KOH (reação xantocroica), por conterem estirilpironas—o que confere coloração marrom aos basidiomas, pela presença de hifas generativas com septos simples e pela presença ou ausência de setas himeniais e/ou tramais (Cannon & Kirk, 2008; Wagner & Fischer, 2002).

Entre os gêneros exclusivamente compostos de espécies poliporoides, *Fomitiporia* foi proposto por Murrill (1907), com *F. langloisii* Murrill como espécie tipo. O gênero caracteriza-se por apresentar basidiomas ressupinados a pileados, basidiósporos globosos a subglobosos, de parede espessada, dextrinoides, cianófilos e com setas himeniais variavelmente presentes (Dai, 2010; Decock *et al.*, 2007). Atualmente cerca de 60 espécies são aceitas, encontradas em diferentes regiões biogeográficas (Olson *et al.*, 2001), como nos Neotrópicos (Amalfi & Decock, 2013; Amalfi *et al.*, 2014; Amalfi & Decock, 2014; Brown *et al.*, 2019; Campos-Santana *et al.*, 2014; Decock *et al.*, 2007; Li *et al.*, 2016; Morera *et al.*, 2017; Rajchenberg *et al.*, 2019), região Neártica (Amalfi *et al.*, 2012; Vlasák & Kout, 2011;

Vlasák & Vlasák Jr., 2016), região Afrotropical (Amalfi *et al.*, 2010; Cloete *et al.*, 2014) e região Indo-Malaia (Chen *et al.*, 2016; Chen & Cui, 2017; Dai *et al.*, 2008; Liu *et al.*, 2018; Zhou & Xue, 2012).

Para o gênero são reportadas espécies de importância econômica, como aquelas que ocorrem em *Vitis vinifera* L. (videira), causando *Esca*, em diferentes países/regiões; EUA (*F. ignea* A.A. Brown, D.P. Lawr. & K. Baumgartner, *F. langloisii*, & *F. polymorpha* M. Fisch.), Austrália (*F. australiensis* M. Fisch., Jacq. Edwards, Cunningt. & Pascoe), Europa (*F. mediterranea* M. Fisch.) e África do Sul (*F. capensis* M. Fisch., Cloete, L. Mostert & Halleen), com ao menos *F. langloisii* e *F. polymorpha* ocorrendo em hospedeiros nativos (Brown *et al.*, 2019; Cloete *et al.*, 2014; Fischer, 2006), como também espécies com relação fungo-hospedeiro espécie-específicas e com distribuição geográfica restrita. Dentre elas estão *F. cupressicola* Amalfi, Raymundo, Valenz. & Decock descrita a partir de espécimes encontrados em *Cupressus arizonica* (México) e *F. tabaquilio*, que vem sendo registrada em *Polylepis australis* e *P. tomentela* (Argentina) (Amalfi *et al.*, 2012; Robledo *et al.*, 2006), além daquelas que ocorrem tanto em hospedeiros nativos como também exóticos (e.g. *F. impercepta*, *F. maxonii*) (Cabrera *et al.*, 2014; Morera *et al.*, 2017).

Na região Neotropical, muitos dos espécimes coletados nos últimos 20 anos, foram identificados com base em análises morfológicas como *F. punctata* (P. Karst.) Murrill e *F. robusta* (P. Karst.) Fiasson & Niemelä (Gilbertson & Ryvarden, 1987; Loguercio-Leite & Wright, 1991; Loguercio-Leite & Wright, 1995; Ryvarden, 1991, 2004; Ryvarden & de Meijer, 2002). Porém estes são táxons originalmente reportados para a Europa (Michael Fischer, 2002; Ryvarden & Gilbertson, 1994) e Ásia (Dai, 1999, 2010; Dai *et al.*, 2008), o que levou alguns trabalhos a questionarem essas identificações e, como resultado, espécies novas têm sido descritas e/ou tratadas como distintas filogeneticamente (Amalfi & Decock, 2013; Vlasák & Kout, 2011; Vlasák & Vlasák Jr., 2016). Estes, através de uma abordagem integrativa, utilizando-se de dados morfológicos, moleculares e ecológicos (distribuição geográfica e relação com hospedeiros/substratos), *F. langloisii*, *F. dryophila* Murrill e *F. maxonii* Murrill, espécies publicadas por Murrill (1907) na proposição do gênero e depois sinonimizadas em *F. punctata*, foram reavaliadas quanto à sinonímia e consideradas como linhagens distintas (Decock *et al.*, 2007). Ainda, Vlasák & Kout (2011), a partir de análises morfológicas e moleculares (nuc-rITS) de espécimes de *F. robusta* dos EUA, obtiveram como resultado duas novas combinações em *Fomitiporia* [*F. bakeri* (Murrill) Vlasák & Kout e *F. calkinsi* (Murrill) Vlasák & Kout] e Raymundo *et al.* (2012), a partir de coletas no México e revisão de espécimes dos EUA, confirmaram que *F. robusta s.str.* não ocorre na América do Norte, tratando o táxon como restrito à Europa e norte da Ásia.

No Brasil, de forma semelhante, muitos dos espécimes pileados de *Fomitiporia* foram identificados como *F. robusta* (Loguercio-Leite *et al.* 2008; Baltazar & Gibertoni 2009; Gomes-Silva & Gibertoni 2009; Gibertoni & Drechsler-Santos 2010 como *Phellinus robustus*), entretanto, como já mencionado, a ocorrência deste táxon é restrita à Eurásia (Raymundo *et al.*, 2012; Vlasák & Kout, 2011), sendo assim importante a revisão destes materiais.

Fomitiporia apiahyna (Speg.) Robledo, Decock & Rajchenb., outro táxon com basidioma pileado, descrito a partir de um espécime coletado no município de Apiaí-SP (Spegazzini, 1887), já foi reportado também para a Flórida (Vlasák & Kout, 2011), México (Raymundo *et al.*, 2012), Costa Rica (Ryvarden, 2004), Panamá (Gilbert *et al.*, 2002), Equador, Guadalupe, Guiana Francesa e Martinica (Amalfi & Decock, 2013) e Argentina (Rajchenberg & Wright, 1987; Wright & Blumenfeld, 1984). No entanto, conforme Amalfi & Decock (2013), esse táxon deve ser considerado um complexo de espécies, e pode apresentar múltiplas linhagens, as quais não têm apresentado diferenças morfológicas significativas; inclusive, duas dessas linhagens podem ocorrer simpatricamente em florestas do Equador e Guiana Francesa, além de outras ocorrendo na Guiana, Guadalupe e México.

Em relação as espécies com basidioma ressupinado, semelhante a *F. robusta*, o nome *F. punctata* também foi utilizado (Ryvarden & de Meijer 2002; Drechsler-Santos *et al.* 2008; Baltazar & Gibertoni 2009; Gomes-Silva & Gibertoni 2009; Loguercio-Leite *et al.* 2009; Gibertoni & Drechsler-Santos 2010 como *Phellinus punctatus*). Outro nome utilizado é *F. maxonii*, (Abrahão *et al.* 2012; Motato-Vásquez & Mello-Gugliotta 2014 para São Paulo), uma espécie descrita a partir de coletas de Cuba, registrada também para a Jamaica, Costa Rica e Venezuela (Decock *et al.*, 2007). Campos-Santana *et al.* (2015), porém, sugeriram que espécimes identificados como *F. maxonii* e *F. punctata* devem ser reavaliados, pois podem representar *F. neotropica* Campos-Santana, Amalfi, R.M. Silveira, Robledo & Decock, a qual é distribuída na Guiana Francesa, sul do Brasil e Argentina (Campos-Santana *et al.*, 2014). Outra espécie que deve ser reavaliada é *F. dryophila*, registrada para o Rio Grande do

Sul (Campos-Santana *et al.*, 2015), supostamente apresentando uma distribuição disjunta, pois é espécie registrada como ocorrente no sul dos EUA e México (Decock *et al.*, 2007; Raymundo *et al.*, 2012). Também sobre as espécies ressupinadas, não se conhecem as relações e a delimitação filogenética de *F. bambusarum* (Rick) Campos-Santana & Decock, registrada para o Nordeste da Argentina e Sul do Brasil (Coelho *et al.* 2009, como *Phellinus bambusarum*; Campos-Santana *et al.* 2015); *F. sanctichampagnatii* G. Coelho, R.M. Silveira & Rajchenb. e *F. spinescens* (J.E. Wright & G. Coelho) G. Coelho, Guerrero & Rajchenb., registradas para o Rio Grande do Sul (Coelho *et al.*, 2009).

Nas últimas filogenias do gênero as espécies neotropicais foram encontradas em um único clado, juntamente com espécies do extremo norte (sul dos EUA) e sul (sul da América do Sul) dessa delimitação biogeográfica (Morrone, 2014; Olson *et al.*, 2001). Ao menos quatro clados têm sido observados: (1) clado *F. langloisii–F. castilloi:* todas as espécies ressupinadas juntamente com uma espécie pileada (*F. castilloi*); (2) clado *F. texana*: três linhagens, duas delas não descritas; (3) clado andino: duas espécies são proximamente relacionadas: *F. baccharidis* e *F. tabaquilio* e (4) clado *F. apiahyna s.lat.*: ao menos cinco linhagens são encontradas, as quais representam o complexo morfológico de espécies, como mencionado acima (Amalfi & Decock, 2013; Amalfi *et al.*, 2014).

Há dois principais motivadores para esse trabalho: um deles refere-se a dificuldade de diferenciar as espécies morfologicamente quando aplicado somente o conceito morfológico de espécie, sendo que muitos dos táxons desse grupo revelam-se complexos morfológicos, principalmente devido à especiação críptica (Giraud *et al.*, 2008; Kohn, 2005; Taylor *et al.*, 2000, 2006). Como visto anteriormente, a partir dos complexos morfológicos e/ou taxonômicos *F. robusta* e *F. punctata*, outros táxons foram descritos e também recircunscritos, como *F. bakeri* e *F. calkinsi* (a partir de *F. robusta*), *F. maxonii*, *F. langloisii*, *F. dryophila* e recentemente *F. neotropica* (de *F. punctata*), ou seja as filogenias moleculares, como em outros grupos (Delić *et al.*, 2017; Miettinen *et al.*, 2018; Palacio *et al.*, 2017; Spirin *et al.*, 2016), podem auxiliar a entendermos as delimitações das espécies. E quanto a isso, temos o segundo motivador, que diz respeito a baixa ou até mesmo inexistente representatividade de espécimes do Brasil nas filogenias do gênero, com *F. atlantica*, *F. neotropica* e *F. subtilissima* representando as únicas espécies/espécimes (Campos-Santana *et al.*, 2014; Li *et al.*, 2016).

Através de uma taxonomia integrativa, somando análises morfológicas, filogenias moleculares e dados ecológicos, esse trabalho teve como objetivo, entender quantas e quais são as espécies que ocorrem no Brasil e quais são as principais características que delimitam as diferentes linhagens nos complexos de espécies, e para isso utilizaram-se as seguintes questões norteadoras: 1. Os espécimes coletados no Brasil tratam-se de linhagens distintas de *F. robusta*, *F. punctata*, *F. dryophila* e *F. maxonii*? 2. *Fomitiporia bambusarum*, *F. spinescens* e *F. sanctichampagnatii* são espécies distintas entre si? Com quais outras linhagens se relacionam? Estariam evolutivamente próximas a linhagem ressupinada neotropical? 3. Todas as linhagens que têm sido encontradas em *F. apiahyna s.lat.* ocorrem no Brasil? São espécies distintas entre si e quais são os caracteres que as separariam?

2. MATERIAL E MÉTODOS

2.1. Área de estudo, coletas e análises morfológicas

Foram realizadas expedições de coleta em pontos que abrangem os cinco biomas no território nacional, com ênfase nos estados do sul do Brasil, tentando abranger as várias fitofisionomias nos estados do Paraná, Santa Catarina e Rio Grande do Sul. Mapas da distribuição geográfica das espécies foram geradas no QGIS 3.0.3 ‘Girona’ (Sherman *et al.*, 2012), conforme regionalização proposta por Morrone (2014) e *shapefiles* disponibilizados por Löwenberg-Neto (2014).

Os basidiomas foram coletados, fotografados e georreferenciados. Fragmentos dos basidiomas foram armazenados envoltos por papel poroso e armazenados em sacos *ziplock* com sílica gel azul ou em tubos *eppendorf* com tampão CTAB, a fim de preservar o DNA para estudos moleculares. Para a desidratação, os espécimes foram mantidos por 12h–24h em desidratadora de alimentos (30 ºC–35 ºC). Após a descrição e identificação os materiais foram depositados no herbário ICN da Universidade Federal do Rio Grande do Sul.

Para análise e comparação foram solicitados materiais tipo e de referência de herbários do Brasil (FLOR, ICN, INPA, HFSL, PACA, URM, JPB, SP, FURB, HUEFS) e do exterior (LPS, BAFC).

Os basidiomas coletados e os provenientes de coleções de herbários foram analisados quanto aos caracteres macro e microscópicos. Entre os caracteres macroscópicos, foram observados: hábito (séssil/ressupinado/efuso-reflexo), inserção no substrato, sazonalidade, dimensões do basidioma, superfície do píleo (textura, coloração, rimosidade), superfície himenoforal (tamanho, forma, coloração e disposição dos poros e dissepimento), bem como os tubos (cor, estratificação e profundidade) e contexto (presença ou ausência de linhas; textura e coloração). A determinação das cores foi de acordo com o catálogo de Kornerup & Wanscher (1978).

Dentre os caracteres microscópicos, foram observados: sistema hifal em todas as partes do basidioma (superfície do píleo, contexto e tubos), presença ou ausência de elementos estéreis (setas, cistidíolos), presença ou ausência de reações químicas (reagentes de Melzer e Azul de Algodão), além da forma e tamanho dos basídios e basidiósporos. Para a microscopia, foram realizados cortes dos basidiomas (superfície do píleo, contexto e dos tubos). Os cortes foram montados em lâminas e lamínulas de acordo com Teixeira (1995): KOH 3% (hidratante para observação da coloração das hifas e basidiósporos), Floxina 1% (corante citoplasmático para observar as características das hifas generativas, himênio e basidiósporos), reagente de Melzer (reagente a base de iodo para observar a presença da reação dextrinoide ou amiloide nos basidiósporos) e azul-de-algodão (*cotton-blue*, para verificar reação cianófila). A observação e mensuração (n = 40) das estruturas foram realizadas com ocular micrométrica e os valores foram tabulados em planilha do Microsoft Excel, tanto para calcular a média (*ave*), quanto a razão entre o comprimento e o diâmetro (diam.) dos basidiósporos (Q) e sua média (*ave*Q). Também foi calculada a variação em 5% dos valores menores e maiores e os valores menores e maiores de 100% da amostragem, representados entre parênteses quando pertinente. A fórmula utilizada foi a de percentil [=PERCENTIL.INC(matriz;k)], onde k = percentil e a matriz corresponde às 40 medições, tanto de comprimento, quanto de diâmetro, calculados separadamente. Apresentado graficamente como, COMPRIMENTO (k=0$^{\text{hífen}}$)k=0,05$^{\text{hífen}}$k=0,95($^{\text{hífen}}$k=1) × DIÂMETRO (k=0$^{\text{hífen}}$)k=0,05$^{\text{hífen}}$k=0,95($^{\text{hífen}}$k=1) [exemplo: (4–)5–6(–7) × (4–)5–6(–7)].

2.2. Análises moleculares

2.2.1. Extração, amplificação e sequenciamento

Para a extração do DNA total dos espécimes coletados e oriundos de coleções, utilizou-se protocolo modificado de Góes-Neto *et al.*, (2005), conforme Apêndice G. Foram amplificadas, através de reações de PCR (*Polymerase Chain Reaction*) as regiões nucleares ribossomais (nuc-r): segunda maior subunidade (LSU: D1, D2 e D3) e espaçadores internos transcritos (ITS) 1 e 2 e 5.8S (ITS: ITS1+5.8S+ITS2); segunda subunidade maior da RNA polimerase II (*RPB2*) (domínios 6 e 7) e fator de elongação 1α (*TEF1-α*) parcial, utilizando os seguintes pares de primers: LR0R/LR7 (Cubeta *et al.*, 1991; Vilgalys & Hester, 1990); ITS8F/ITS6R (Dentinger *et al.*, 2010); fRPB2-6F/bRPB2-7.1R (Frøslev *et al.*, 2005; Matheny, 2005) e EF1-983F/EF1-2212R (Wendland & Kothe, 1997). Os fragmentos de DNA foram corados com o intercalante de DNA (*SYBR™ Safe DNA Gel Stain*) e submetidos com *gel loading buffer* a eletroforese horizontal em gel de agarose 2%. Os resultados positivos foram identificados como bandas únicas e homogêneas sob luz UV. Os sequenciamentos foram realizados na Fiocruz de Belo Horizonte. Somente para o LSU e *TEF1-α* os pares de primers para o sequenciamento foram diferentes: LR0R-LR5 e 1567R-2212R, respectivamente.

2.2.2. Edição, alinhamento de sequências e reconstruções filogenéticas

As sequências geradas foram corrigidas manualmente *Geneious* v9 (Kearse *et al.*, 2012). As sequências obtidas, juntamente com outras do GenBank, foram alinhadas utilizando o software MAFFT v7 (Katoh & Standley, 2013) e verificadas manualmente utilizando o programa MEGA v7 (Kumar *et al.*, 2016).

Todas as análises filogenéticas foram realizadas na plataforma CIPRES (Miller *et al.*, 2011). As análises de Máxima Verossimilhança foram rodadas no RAxML 8.2.9 (Stamatakis, 2014). As análises de inferência Bayesiana foram conduzidas no Mr. Bayes v. 3.2.6 (Ronquist *et al.*, 2012). Para escolha do modelo evolutivo foi utilizado o MrModeltest 2.3 (Nylander, 2004). Para mais detalhes veja Material e Métodos dos manuscritos.

3. RESULTADOS GERAIS

3.1. Expedições de coleta, espécimes coletados e revisões de herbários

As expedições de coleta foram realizadas entre maio de 2016 e setembro de 2018. A região com maior amostragem foi o sul do Brasil, mas também foi possível realizar coletas na Mata Atlântica e Caatinga da Bahia, Cerrado e Amazônia mato-grossense e em Manaus (Apêndice A). Ao todo 314 espécimes foram analisados e identificados em 24 espécies já descritas ou aqui propostas. Das revisões de herbários resultaram 117 espécimes estudados, enquanto coletas próprias e de colaboradores somaram 197. A lista de espécimes e as espécies que eles correspondem foram listadas no Apêndice B, como também tratados no decorrer dos manuscritos.

3.2. Análises moleculares

Foram obtidas 167 sequências de 58 espécimes (nrITS 50, nrLSU 40, *TEF1* 36 e *RPB2* 41). Os espécimes com os quatros marcadores sequenciados correspondem cerca de 50 %, enquanto que com 3, 15 %, com 2, 7 % e com 1, 27 %. Ao menos nove conjunto de dados foram montados, tanto para cada um dos marcadores (Apêndices C–F) como também análises combinadas (veja nos Manuscritos). Através das reconstruções filogenéticas, tanto com *RPB2* e *TEF1* separadamente, como nos filogramas multilocus, todos os espécimes desse estudo foram encontrados em um único clado: o clado Neotropical. O clado Neotropical se divide em ao menos outros sete clados: (1) *F. texana*, (2) *F. langloisii–F. castilloi*, (3) *F. elegans*, (4) Andino, (5) *F. biformis* ad int., (6) *F. atlantica–F. subtilissima* e (7) *F. apiahyna sensu lato*. Parte das linhagens de *F. apiahyna s.lat.* são tratadas no manuscrito I, no qual é estabelecido *F. apiahyna s.str.* e são propostas três espécies e uma combinação novas (**Manuscrito I: The Neotropical *Fomitiporia* (Hymenochaetales, Basidiomycota): the redefinition of *F. apiahyna* s.s. allows revealing a high hidden species diversity**). No clado *F. langloisii–F. castilloi* foram encontradas oito linhagens desconhecidas. Destas, as quais foram coletadas ocorrendo em bambus foram discutidas no manuscrito II, com a proposição de uma espécie nova e o entendimento das relações filogenéticas desse grupo ecológico (**Manuscrito II: Bambusicolous *Fomitiporia* revisited: multilocus phylogeny reveals a clade of host-exclusive species**). Por fim, no manuscrito III são propostas outras nove espécies novas de diferentes clados, com *F. castilloi* e *F. impercepta* encontradas como novos registros para o Brasil (**Manuscrito III: Neotropical *Fomitiporia* diversity revealed: nine new species and new records from Brazil based on multilocus phylogeny**).

Como um resumo dos resultados, nos manuscritos apresentados são propostas 13 novas espécies, uma combinação nova e dois registros de primeira ocorrência para o Brasil. Sendo assim, amplia-se de oito (*F. apiahyna*, *F. atlantica*, *F. bambusarum*, *F. maxonii*, *F. neotropica*, *F. sanctichampagnatii*, *F. spinescens* e *F. subtilissima*), com a exclusão de *F. dryophila*, *F. punctata* e *F. robusta* para 23 espécies registradas do gênero no Brasil.

MANUSCRITO I — The Neotropical *Fomitiporia* (Hymenochaetales, Basidiomycota): the redefinition of *F. apiahyna* s.s. allows revealing a high hidden species diversity

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ORIGINAL ARTICLE

The Neotropical *Fomitiporia* (Hymenochaetales, Basidiomycota): the redefinition of *F. apiahyna* s.s. allows revealing a high hidden species diversity

Genivaldo Alves-Silva[1,2] · Mateus Arduvino Reck[3] · Rosa Mara Borges da Silveira[2] · Felipe Bittencourt[1] · Gerardo Lucio Robledo[4] · Aristóteles Góes-Neto[5] · Elisandro Ricardo Drechsler-Santos[1]

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Abstract

The Neotropical species *Fomitiporia apiahyna* was repeatedly shown to form a lineage with multiple sublineages that could correspond to different phylogenetic species, hence forming a highly diverse species complex. Due to their inconspicuous morphological features, species delimitation in this complex needs an integrative taxonomic perspective. In this study, we have performed multilocus molecular (ITS, ncLSU, *TEF*-1α, and *RPB2*) analyses in order to delimit the phylogenetic placement of specimens previously determined as *F. apiahyna* and to determine the phylogenetic diversity in term of clades that could be equated to species. Both morphological, ecological, and distribution data have been integrated to better delimit species boundaries. The *F. apiahyna* sensu lato lineage was shown to encompass four clades, corresponding to the four species: *F. apiahyna* sensu stricto, which is confirmed based on specimens originating from the type locality and here epitypified; *F. nubicola* sp. nov., proposed based on specimens found on *Drimys angustifolia* and *Drimys* sp., a relic plant species distributed exclusively in fragmented forests of high altitude areas in southern Brazil; *F. conyana* sp. nov., proposed from specimens previously suggested as the closest to *F. apiahyna* s.s.; and *F. murrilli* sp. nov., proposed based on specimens found on the locally exotic *Eucalyptus* sp. and another undefined angiosperm in southern Brazil. Additionally, *Phellinus elegans* emerged from the synonymy of *F. apiahyna* and the new combination *Fomitiporia elegans* is proposed. An identification key to the Neotropical species with pileate basidioma also is provided. Phylogenetically delimited species are strongly supported by ecological data, and in the case of *F. conyana* by clear-cut morphological data. It is expected that, with the redefinition of *F. apiahyna* s.s., other phylogenetic species will emerge in the near future.

Keywords Cryptic species · Hymenochaetales · Integrative taxonomy · IUCN fungi red listing · Neotropical fungi · New taxa · Multilocus phylogeny · Species complexes

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✉ Genivaldo Alves-Silva
genivaldobio@gmail.com

[1] Programa de Pós-Graduação em Biologia de Fungos, Algas e Plantas, Departamento de Botânica, Universidade Federal de Santa Catarina, Campus Universitário Trindade, Florianópolis, Santa Catarina 88040-900, Brazil

[2] Programa de Pós-Graduação em Botânica, Departamento de Botânica, Universidade Federal do Rio Grande do Sul, Campus do Vale, Porto Alegre, Rio Grande do Sul 91501-970, Brazil

[3] Departamento de Biologia, Universidade Estadual de Maringá, Campus Universitário, Av. Colombo 5790, Jardim Universitário, Maringá, PR CEP 87020-900, Brazil

[4] Facultad de Ciencias Agropecuarias-CONICET, Centro de Biotecnología Aplicada al Agro y Alimentos (BioTecA3), Universidad Nacional de Córdoba, Ing. Agr. Félix Aldo Marrone 746 - Planta Baja, CC509, CP 5000, Ciudad Universitaria, Córdoba, Argentina; Fundación FungiCosmos, Av. General Paz 154, 4° piso, oficina 4, Córdoba, Argentina

[5] Instituto de Ciências Biológicas (ICB), Departamento de Microbiologia, Laboratório de Biologia Molecular e Computacional de Fungos (LBMCF), Universidade Federal de Minas Gerais, Av. Antônio Carlos, 6627, Belo Horizonte, MG CEP 31270-901, Brazil

Introduction

Polypores, like many other basidiomycetes, have relatively few morphological characters and rather low level of variation of these characters; this may result from speciation processes with no morphological differentiation, convergent morphological traits, or misunderstanding by the taxonomists of these characters and their variations; hence, the combination of presence/absence of a character and its range of variation often do not allow accurate species identification. Species complex is a hypothesis based on these facts, and that should be tested by other data than morphological, like ecology, and nowadays, genomic data (Hibbett et al. 1993, Haight et al. 2016, Li et al. 2016b, Spirin et al. 2016, Watkinson et al. 2015, Palacio et al. 2017). The current large number of species complexes negatively impacts the recognition of a high species diversity of fungi, and, consequently, its conservation (Bickford et al. 2007; Dussex et al. 2018). This is the case in *Hymenochaetales*, a group of wood-inhabiting saprotrophic or phytopathogenic Basidiomycota in which the species boundaries were historically questioned (Fiasson and Niemelä 1984; Parmasto 1985; Fischer 1996; Wagner and Fischer 2001, 2002; Fischer and Binder 2004; Drechsler-Santos et al. 2016).

Among the polyporoid genera of *Hymenochaetales*, *Fomitiporia* is well known for harboring such morphological species complexes. *Fomitiporia* was for a long time considered the *F. robusta-punctata* species complex (as *Phellinus robustus* complex, David et al. 1982, Ryvarden and Gilbertson 1994), which, due to its inconspicuous morphological features, was reported as widely distributed (Gilbertson 1979; Gilbertson and Ryvarden 1987; Rajchenberg 1987; Ryvarden 2004; Loguercio-Leite et al. 2008; Dai 2010). Consequently, most *Fomitiporia* species cited for Brazilian Funga (Kuhar et al. 2018) were named referring to this complex (e.g., Loguercio-Leite et al. 2008; Gibertoni and Drechsler-Santos 2010). It is probable that these specimens represent distinct species from those originally reported, and therefore, detailed morphological and phylogenetic studies are necessary to reveal cryptic species, some of them likely to have restricted distributions.

In the Neotropics, *Fomitiporia* has received much attention only recently (Amalfi and Decock 2013, 2014; Amalfi et al. 2014; Campos-Santana et al. 2014, 2015; Decock et al. 2007; Li et al. 2016a; Vlasák and Vlasák Jr 2016; Morera et al. 2017; Rajchenberg et al. 2019). Several taxa were newly described including, e.g., *F. bambusipileata* (Alves-Silva et al. 2020), *F. chilensis* (Rajchenberg et al. 2019)*, F. impercepta* (Morera et al. 2017), *F. atlantica*, *F. subtilissima* (Li et al. 2016a), *F. expansa*, and *F. neotropica*. The most recent phylogenetic analyses of *Fomitiporia* comprised an extensive sampling of this genus, and they notably showed interesting evolutionary histories, concerning both biogeographical and morphological features (Amalfi and Decock 2013).

The Neotropical species have been retrieved in a single lineage. The species with resupinate basidioma have been recovered and grouped within this clade (Amalfi and Decock 2013; Amalfi et al. 2014; Campos-Santana et al. 2014). Among the pileate species, *F. apiahyna*, originally described from a single specimen collected in the Atlantic Forest of southeastern Brazil (Spegazzini 1887), is reported from southern Florida and northern Mexico (Vlasák et al. 2011; Raymundo et al. 2012) to southern Brazil and northeastern Argentina (Wright and Blumenfeld 1984; Rajchenberg and Wright 1987; Loguercio-Leite et al. 2008). However, this wide distribution has already been used by Amalfi and Decock (2013) to suggest that *F. apiahyna* should be considered in a broad sense. Amalfi and Decock (2013) performed a phylogenetic study with collections from Ecuador, French Guiana, Guadalupe, Guiana, and Mexico. As a result, five distinct lineages (from which four were named as phylogenetic species—PS) were retrieved within *F. apiahyna* sensu lato (s.l.) lineage. Furthermore, from Ecuador and French Guiana collections, Amalfi and Decock (2013) proposed *F. apiahyna* sensu authors mainly based on gross morphological similarities with the holotype.

Pursuing the taxonomic and phylogenetic studies of the Neotropical *Fomitiporia*, our study aimed to understand the species boundaries of the *F. apiahyna* species complex. We provided multiple loci phylogenetic analyses from four distinct DNA genomic regions (ncLSU, ITS, *TEF*-1α, and *RPB2*), critical morphological studies, including revision of type specimens, and analyzed an eco-biogeographical perspective.

Materials and methods

Study areas

Geographic distribution of species is presented from the Neotropical regionalization proposed by Morrone (2014). The map was built with QGIS 3.0.3 'Girona' (2019) from shape files provided by Löwenberg-Neto (2014). The geographical coordinates of specimens from Ecuador and French Guiana are available in Amalfi and Decock (2013). The specimens of this study were collected in the domains of Chacoan, Parana, and South-eastern Amazonian, in the provinces of Araucaria Forest, Atlantic, Cerrado, Pampean, Parana Forest, and Xingu-Tapajós.

Morphological analysis

Basidiomata colors were described according to Kornerup and Wanscher (1978). Hand-cut sections of basidiomata were examined in Melzer's reagent to check dextrinoidity, Cotton Blue (CB) in lactic acid (Kirk et al. 2008) to check for cyanophily, distilled water to observe the natural color of the structures, KOH 3% to check the xanthocroic reaction, and Phloxine 1% plus KOH 3% to observe the hymenium (Largent et al. 1977; Ryvarden 1991). All microscopic measurements were made in Melzer's reagent. In order to determine the size range of pores, hyphae, and basidiospores, 5% of the measurements at each end of the range are given in parentheses when relevant, and forty basidiospores were measured. In the text, the following abbreviations were used: ave. = average, diam. = diameter, *Q* = the range of the ratio length/width, *Q*m = the mean of the ratio length/width from basidiospores measurements. The microstructures description was according to Kirk et al. (2008). To construct the identification key, features from species not studied here were obtained from protologues and/or from type studies (Robledo et al. 2003; Ryvarden 2004; Amalfi and Decock 2013; Amalfi et al. 2014). Herbarium acronyms followed Thiers (2018).

Boxplots were generated in "R" software (R Core Team 2013) based on length and width of basidiospores from a number of specimens of the *F. apiahyna* complex: ICN200545, ICN200546, ICN200542, ICN200544, ICN200547, LPS24922, FLOR58553, *n* = 280/7; BAFC24382, FLOR58556, FLOR58570, FURB44484, *n* = 200/5; FLOR57850, FLOR57851, FLOR57852, FLOR57853, FLOR57854, FLOR57855, FLOR57856, FLOR57857, FLOR57858, FLOR57859, *n* = 320/8; ICN200553, ICN200555, ICN200556, *n* = 120/3; and ICN200550, ICN200552, ICN200551, ICN200548, FLOR58547, FLOR58546, FLOR58548, FLOR58549, FLOR58563, FURB47595, *n* = 400/10. For statistical analysis, universal ANOVA and paired Wilcoxon test *p* values were generated with "ggpubr" package.

DNA extraction, PCR amplification, and sequencing

Dried basidiomata were used for the DNA extraction with the CTAB method modified from Góes-Neto et al. (2005). The primer pairs ITS8F-ITS6R (Dentinger et al. 2010) and LR0R-LR7 (Vilgalys and Hester 1990) were used to amplify the 5′ end of the ITS (ITS1-5.8S-ITS2) and ncLSU (nc 28S rDNA), respectively. For *TEF*-1α, a fragment between exons 4 and 8 (Wendland and Kothe 1997) was amplified with the primer pair 983F and 2212R (Rehner and Buckley 2005), and for *RPB2*, the region among domains 5, 6, and 7 using primers f*RPB2*-5F and b*RPB2*-7.1R (Frøslev et al. 2005; Matheny 2005). All PCR products were purified with PEG 20% (Polyethylene glycol 8000 and 2.5 M NaCl), and sequencing reactions of PCR products were prepared with addition of a mix composed by 1 μL BigDye® Terminator v3.1 Cycle Sequencing Kit (Applied Biosystems, Foster City, CA, USA), 1 μL 5 × buffer, 1 μL primer, 5 μL H_2O q.s.p., and 2 μL of the amplification product. For sequencing, the same primers were used, except for *RPB2*, which the b*RPB2*-6F was used also in addition to f*RPB2*-5F and b*RPB2*-7.1R in some samples (Matheny 2006). Sequencing reactions and sequencing were performed at the Centro de Pesquisas René Rachou from FIOCRUZ (Belo Horizonte, Brazil) as part of the FungiBrBol (www.brbol.org).

Phylogenetic analysis

A total of 156 specimens representing 53 (52 ingroup) species or potential species/clades were included in the phylogenetic analyses. All *Fomitiporia* sequences are available in GenBank, mainly from Amalfi and Decock (2013). We selected *Phellinus uncisetus* as the outgroup based on previous studies (Amalfi et al. 2010, 2012, 2014; Amalfi and Decock 2013). All materials and sequences used in our study are listed in Table 1.

Sequences were assembled and manually corrected with Geneious v. 6.1.8 (Kearse et al. 2012), then automatically aligned with MAFFT v.7 (Katoh and Standley 2013) under the Q-INS-I strategy for ITS and G-INS-i strategy for the remainder. The alignment was manually adjusted when necessary. For protein-coding gene sequences, the assignment of codon positions was confirmed by translating nucleotide sequences into predicted amino acid sequences with MEGA v. 6.0 (Tamura et al. 2013). Potentially ambiguously aligned segments to ITS1-5.8S-ITS2 were detected by Gblocks 0.91b (Castresana 2000) using the following block parameters: the minimum number of sequences for conserved positions was 53% from total sequences, the minimum number of sequences for flank positions was 55% from total sequences, the maximum number of contiguous non-conserved positions was 8 bp, the minimum length of a block was 2 bp, and the allowed gap position was the "with half" option. The dataset was subdivided into 11 data partitions: ITS1 + 5.8S + ITS2 + ncLSU + *TEF*1-1st + *TEF*1-2nd + *TEF*1-3rd codon positions + *TEF*1 introns + *RPB2*-1st + *RPB2*-2nd + *RPB2*-3rd codon positions (Table 2). The three introns present in *TEF*1 were cut out and analyzed as a distinct partition. The alignment was deposited in TreeBASE, under access number 24524.

All phylogenetic analyses were performed online using the CIPRES Science Gateway (Miller et al. 2011). Bayesian analysis (BI) was performed in the program Mr. Bayes v. 3.2.6 (Ronquist et al. 2012) and evolutionary models for BI were estimated using the AIC (Akaike Information Criterion) for each partition, as implemented in MrModeltest 2.3 (Nylander 2004). The best-fit models for each partition were implemented as partition-specific models within partitioned mixed-model analyses of the combined dataset (Table 2). We set two independent runs, each one starting from random trees, with four simultaneous independent chains and performed 10,000,000 generations, sampling trees at every 100th generation. The convergence diagnostic was calculated every 10,000th generation and its critical value was set to stop the

Table 1 Summary of specimens included in molecular analyses, for which geographical origin, herbarium vouchers, and GenBank accession numbers for each DNA region are provided. New sequences generated in this study are marked in italics

Taxon	Herbarium voucher	Locality	GenBank accession number			
			nrLSU	nrITS	*TEF–1α*	*RPB2*
F. aethiopica	MUCL 44777 (T)	Ethiopia	AY618204	GU478341	GU461893	JQ087956
	MUCL 44806	Ethiopia	AY618202	GU461944	GU461892	JQ087955
F. apiahyna **s.str.**	FLOR 58553	Brazil	*KU663291*	*KU663317*	*KU663342*	–
	ICN 200542	Brazil	*MN918564*	*MN918571*	*MN918580*	*MN918587*
	ICN 200543	Brazil	*MN918565*	*MN918572*	*MN918581*	*MN918588*
	ICN 200544	Brazil	*MN918566*	*MN918573*	*MN918582*	*MN918589*
	ICN 200545	Brazil	–	*MN918574*	*MN918583*	*MN918590*
	ICN 200546	Brazil	*MN918567*	*MN918575*	*MN918584*	*MN918591*
F. atlantica	FLOR 58554 (T)	Brazil	KU557526	KU557528	–	–
F. australiensis	MUCL 49406	Australia	GU462001	AY624997	GU461897	JQ087959
F. baccharidis	MUCL 47756	Argentina	JQ087913	JQ087886	JQ087940	JQ087993
	MUCL 47757	Argentina	JQ087914	JQ087887	JQ087941	JQ087994
	MUCL 47758	Argentina	JQ087915	JQ087888	JQ087942	JQ087995
F. bakeri	MUCL 51098	USA	JQ087901	JQ087874	JQ087928	JQ087960
F. bannaensis	MUCL 45926	Thailand	EF429217	GU461942	GU461898	JQ087961
	MUCL 46950	China	EF429218	GU461943	GU461899	JQ087962
F. calkinsii	MUCL 51100	USA	JQ087902	JQ087875	JQ087929	JQ087963
	MUCL 52346	Mexico	JQ087903	JQ087876	JQ087930	JQ087964
F. capensis	MUCL 53009	South Africa	JQ087917	JQ087890	JQ087944	JQ087997
F. castilloi	MUCL 53481 (T)	French Guiana	JQ087916	JQ087889	JQ087943	JQ087996
	MUCL 53980 (PT)	French Guiana	JX093830	JX093786	JX093743	JX093874
F. conyana **sp. nov.**	MUCL 51451	Ecuador	GU461997	GU461963	GU461896	JQ087958
	MUCL 51454	Ecuador	JX093812	JX093769	JX093725	JX093856
	MUCL 51456	Ecuador	JX093813	JX093770	JX093726	JX093857
	MUCL 51474	Ecuador	JX093814	GU461961	JX093727	JX093858
	MUCL 51485	Ecuador	GU461996	GU461962	GU461895	JQ087957
	MUCL 53022	French Guiana	JX093815	JX093771	JX093728	JX093859
	MUCL 53041	French Guiana	JX093816	JX093772	JX093729	JX093860
	MUCL 53042	French Guiana	JX093817	JX093773	JX093730	JX093861
	MUCL 53047	French Guiana	JX093818	JX093774	JX093731	JX093862
	MUCL 53071	French Guiana	JX093819	JX093775	JX093732	JX093863
	MUCL 53135	French Guiana	JX093820	JX093776	JX093733	JX093864
	MUCL 53145	French Guiana	JX093821	JX093777	JX093734	JX093865
	MUCL 53149	French Guiana	JX093822	JX093778	JX093735	JX093866
	MUCL 53156	French Guiana	JX093823	JX093779	JX093736	JX093867
	MUCL 53711	French Guiana	JX093824	JX093780	JX093737	JX093868
	MUCL 53988	French Guiana	JX093825	JX093781	JX093738	JX093869
	MUCL 53989	French Guiana	JX093826	JX093782	JX093739	JX093870
	MUCL 53990	French Guiana	JX093827	JX093783	JX093740	JX093871
	MUCL 53991	French Guiana	JX093828	JX093784	JX093741	JX093872
	MUCL 53726	French Guiana	JX093829	JX093785	JX093742	JX093873
	FLOR 58546	Brazil	*KU663269*	*KU663297*	–	*KU663347*
	FLOR 58547	Brazil	*KU663270*	*KU663298*	*KU663324*	*KU663348*
	FLOR 58548	Brazil	*KU663271*	*KU663299*	*KU663325*	*KU663349*
	FURB 47595	Brazil	*KU663272*	*KU663300*	*KU663326*	*KU663350*
	FLOR 58563	Brazil	*KU663273*	*KU663301*	–	–

Table 1 (continued)

Taxon	Herbarium voucher	Locality	GenBank accession number			
			nrLSU	nrITS	*TEF−1α*	*RPB2*
	FLOR 58549	Brazil	*KU663274*	*KU663302*	*KU663327*	*KU663351*
	ICN 200552	Brazil	*MN918568*	*MN918576*	–	–
F. cupressicola	MUCL 52486 (T)	Mexico	JQ087904	JQ087877	JQ087931	JQ087965
	MUCL 52488	Mexico	JQ087905	JQ087878	JQ087932	JQ087966
	MUCL 52489	Mexico	JQ087906	JQ087879	JQ087933	JQ087967
	MUCL 52490	Mexico	JQ087907	JQ087880	JQ087934	JQ087968
F. dryophila	MUCL 46379	USA	EF429221	EF429240	GU461902	JQ087969
	MUCL 46380	USA	EF429219	EF429238	GU461900	JQ087970
F. elegans **comb. nov.**	FLOR 58556	Brazil	*KU663293*	*KU663319*	*KU663344*	*KU663368*
	FURB 44484	Brazil	–	*KU663320*	–	*KU663369*
F. erecta	MUCL 49871	France	GU461976	GU461939	GU461903	JQ087971
F. expansa	MUCL 55026	French Guiana	KJ401032	KJ401031	KJ401033	KJ401034
F. gabonensis	MUCL 47576 (T)	Gabon	GU461990	GU461971	GU461923	JQ087972
	MUCL 51291	Gabon	GU461986	GU461967	GU461924	JQ087973
F. hartigii	MUCL 31400	Japan	JQ087909	JQ087882	JQ087936	JQ087975
	MUCL 53549	Estonia	JX093831	JX093787	JX093744	JX093875
	MUCL 53550	Estonia	JX093832	JX093788	JX093745	JX093876
	MUCL 53550	Estonia	JX093833	JX093789	JX093746	JX093877
F. hippophaeicola	MUCL 31746	Belgium	AY618207	GU461945	GU461904	JQ087976
	MUCL 31747	Belgium	GU461977	GU461946	GU461905	JQ087977
F. impercepta	MUCL 53675	French Guiana	JX093835	JX093791	JX093748	JX093879
	MUCL 46181	Argentina	EF429234	EF433563	GU461930	JQ088007
F. ivindoensis	MUCL 51311	Gabon	GU461979	GU461952	GU461907	JQ087978
	MUCL 51312 (T)	Gabon	GU461978	GU461951	GU461906	JQ087979
F. juniperina	MUCL 51757	Tunisia	JQ087927	JQ087900	JQ087954	JQ088019
	MA PA01	Italy	KF444726	KF444703	KF444776	KF444749
	MA PA02	Italy	KF444727	KF444704	KF444777	KF444750
F. langloisii	MUCL 46375	USA	EF429225	EF429242	GU461908	JQ087980
	MUCL 46165	USA	EF429223	AY340026	GU461909	JQ087981
F. maxonii	MUCL 46017	Cuba	EF429230	EF433559	GU461910	JQ087983
	MUCL 46037	Cuba	EF429231	EF433560	GU461911	JQ087982
	MUCL 51331	Argentina	KF444714	KF444691	KF444764	–
F. mediterranea	AFTOL ID 688	ND	AY684157	AY854080	AY885149	AY803748
	MUCL 38514	Italy	AY618201	GU461953	GU461912	JQ087984
	MUCL 45670	France	GU461980	GU461954	GU461913	JQ087985
F. murrilli **sp. nov.**	ICN 200553	Brazil	*MN918569*	*MN918577*	*MN918585*	*MN918592*
	ICN 200555	Brazil	*MN918570*	*MN918578*	*MN918586*	*MN918593*
F. neotropica	MUCL 53114	French Guiana	JX093836	JX093792	JX093749	JX093880
	MUCL 51335 (T)	Argentina	KF444721	KF444698	KF444771	KF444744
	MUCL 51336 (PT)	Argentina	KF444722	KF444699	KF444772	KF444745
	MUCL 54206	Brazil	KF444723	KF444700	KF444773	KF444746
	MUCL 54246	Brazil	KF444720	KF444697	KF444770	KF444743
F. nobilissima	MUCL 47580	Gabon	GU461985	GU461966	GU461921	JQ087986
	MUCL 51289 (T)	Gabon	GU461984	GU461965	GU461920	JQ087987
F. norbulingka	Cui 9770	China Tibet	KU364430	KU364420	KU364433	KU364441
	Cui 9722	China Tibet	KU364429	KU364419	KU364434	KU364440
	Cui 9777	China Tibet	KU364428	KU364418	KU364432	KU364439

Table 1 (continued)

Taxon	Herbarium voucher	Locality	GenBank accession number			
			nrLSU	nrITS	*TEF–1α*	*RPB2*
	Cui 9766	China Tibet	KU364427	KU364417	KU364431	KU364438
F. nubicola **sp. nov.**	FLOR 57850 (T)	Brazil	*KU663275*	*KU663303*	*KU663328*	*KU663352*
	FLOR 57851	Brazil	*KU663276*	*KU663304*	*KU663329*	*KU663353*
	FLOR 57852	Brazil	*KU663277*	*KU663305*	*KU663330*	*KU663354*
	FLOR 57853	Brazil	*KU663278*	*KU663306*	*KU663331*	*KU663355*
	FLOR 57854	Brazil	*KU663279*	–	*KU663332*	*KU663356*
	FLOR 57855	Brazil	*KU663280*	*KU663307*	*KU663333*	*KU663357*
	FLOR 57856	Brazil	*KU663281*	*KU663308*	–	*KU663358*
	FLOR 57857	Brazil	*KU663282*	*KU663309*	*KU663334*	*KU663359*
	FLOR 57858	Brazil	*KU663283*	*KU663310*	*KU663335*	*KU663360*
	FLOR 57859	Brazil	*KU663284*	*KU663311*	*KU663336*	*KU663361*
	FLOR 58545	Brazil	*KU663285*	*KU663312*	*KU663337*	*KU663362*
	FURB 52808	Brazil	–	*MN918579*	–	–
F. polymorpha	MUCL 46166 (PT)	USA	DQ122393	GU461955	GU461914	JQ087988
	MUCL 46167 (PT)	USA	EF429233	GU461956	GU461915	JQ087989
F. pseudopunctata	MUCL 51325	Czech	GU461981	GU461948	GU461916	JQ087998
	MUCL 46168	France	JQ087918	JQ087891	JQ087945	JQ087999
F. punctata	MUCL 34101	Germany	AY618200	GU461947	GU461917	JQ088000
	MUCL 47629	Japan	GU461982	GU461950	GU461918	JQ088001
	MUCL 53548	Europe	JX093834	JX093790	JX093747	JX093878
F. punicata	Cui 23	China	GU461991	GU461974	GU461927	JQ088002
	Cui 26	China	GU461992	GU461975	GU461928	JQ088003
F. robusta	MUCL 51297	Estonia	JQ087919	JQ087892	JQ087946	JQ088004
	MUCL 51327	Czech	GU461993	GU461949	GU461929	JQ088005
F. sonorae	MUCL 47689 (T)	USA	JQ087920	JQ087893	JQ087947	JQ088006
F. "sp."	MUCL 52350	Mexico	JQ087912	JQ087885	JQ087939	JQ087992
F. "sp."	MUCL 51105	USA	JQ087911	JQ087884	JQ087938	JQ087991
F. "sp."	MUCL 51106	USA	JQ087910	JQ087883	JQ087937	JQ087990
F. "sp." PS1	TH 8903	Guyana	JX093837	JX093793	JX093750	–
	TH 8904	Guyana	JX093838	JX093794	JX093751	–
F. "sp." PS2	MUCL 53108	French Guiana	JX093839	JX093795	JX093752	JX093881
	MUCL 53705	French Guiana	JX093840	JX093796	JX093753	JX093882
	MUCL 53992	Guadalupe	JX093841	JX093797	JX093754	JX093883
F. "sp." PS3a	MUCL 51464	Ecuador	JX093842	JX093798	JX093755	JX093884
	MUCL 53034	French Guiana	JX093843	JX093799	JX093756	JX093885
	MUCL 53106	French Guiana	JX093844	JX093800	JX093757	JX093886
	MUCL 53111	French Guiana	JX093845	JX093801	JX093758	JX093887
	MUCL 53785	French Guiana	JX093846	JX093802	JX093759	JX093888
	MUCL 53793	French Guiana	JX093847	JX093803	JX093760	JX093889
	MUCL 53800	French Guiana	JX093848	JX093804	JX093761	JX093890
	MUCL 53985	French Guiana	JX093849	JX093805	JX093762	JX093891
F. "sp." PS3b	GC–FG–10–125	French Guiana	JX093850	JX093806	JX093763	JX093892
F. "sp." PS4	MUCL 53993	Mexico	JX093851	JX093807	JX093764	JX093893
	MUCL 53994	Mexico	JX093852	JX093808	JX093765	JX093894
F. "sp." PS5	MUCL 51555	Martinique	JX093853	JX093809	JX093766	JX093895
	MUCL 5379	French Guiana	JX093854	JX093810	JX093767	JX093896
F. "sp." PS6	MUCL 53798	French Guiana	JX093855	JX093811	JX093768	JX093897

Table 1 (continued)

Taxon	Herbarium voucher	Locality	GenBank accession number			
			nrLSU	nrITS	*TEF−1α*	*RPB2*
F. subhippophaeicola	Cui 12,102	China Tibet	KU364424	KU364423	KU364435	KU364444
	Cui 9332	China Tibet	KU364425	KU364422	KU364436	KU364443
	Cui 12,096	China Tibet	KU364426	KU364421	KU364437	KU364442
F. subtilissima	FURB 47557 (T)	Brazil	KU557527	KU557531	KU557532	KU557533
F. tabaquilio	MUCL 46230	Argentina	DQ122394	GU461940	GU461931	JQ088008
	MUCL 47754	Argentina	GU461994	GU461941	GU461932	JQ088009
F. tenuis	MUCL 44802 (T)	Ethiopia	AY618206	GU461957	GU461934	JQ088010
	MUCL 49948	Gabon	GU461998	GU461958	GU461935	JQ088011
F. texana	MUCL 47690	USA	JQ087921	JQ087894	JQ087948	JQ088013
	MUCL 51143	USA	JQ087922	JQ087895	JQ087949	JQ088014
F. torreyae	MUCL 47628	Japan	JQ087923	JQ087896	JQ087950	JQ088015
	WC3	China	JQ087924	JQ087897	JQ087951	JQ088016
F. tsugina	MUCL 52702	USA	JQ087925	JQ087898	JQ087952	JQ088017
	MUCL 52703	USA	JQ087926	JQ087899	JQ087953	JQ088018
	MUCL 51295	USA	JQ087908	JQ087881	JQ087935	JQ087974
P. uncisetus	MUCL 46231	Argentina	EF429235	GU461960	GU461937	JQ088020
	MUCL 47061	Argentina	GU462000	GU461972	GU461938	JQ088021

analysis automatically when the standard deviation of the split frequencies reached the value defined by the stopval command (stoprule = yes, stopval = 0.01). Twenty-five percent of sampled trees was discarded as burn-in, while the remainder was used to reconstruct a 50% majority-rule consensus tree and to estimate Bayesian posterior probabilities (BPPs) of the branches. A BPP value above 0.99 was considered high support.

Maximum likelihood (ML) analysis was carried out in RAxML v.8 (Stamatakis 2014). The analysis first involved 100 ML searches, each one starting from one randomized stepwise addition parsimony tree, under a GTRGAMMAI model, with all parameters estimated by the software. We provided a partition file to force RAxML software to search for a separate evolution model for each dataset. To access the reliability of the nodes, rapid bootstrapping replicates under the same model are computed, allowing the program to halt bootstrapping automatically via the autoMRE option (Pattengale et al. 2009). Bootstrap (BS) values above 90 were considered significant (high support) and above 70 were considered moderate support.

Results

Molecular phylogenetic analyses

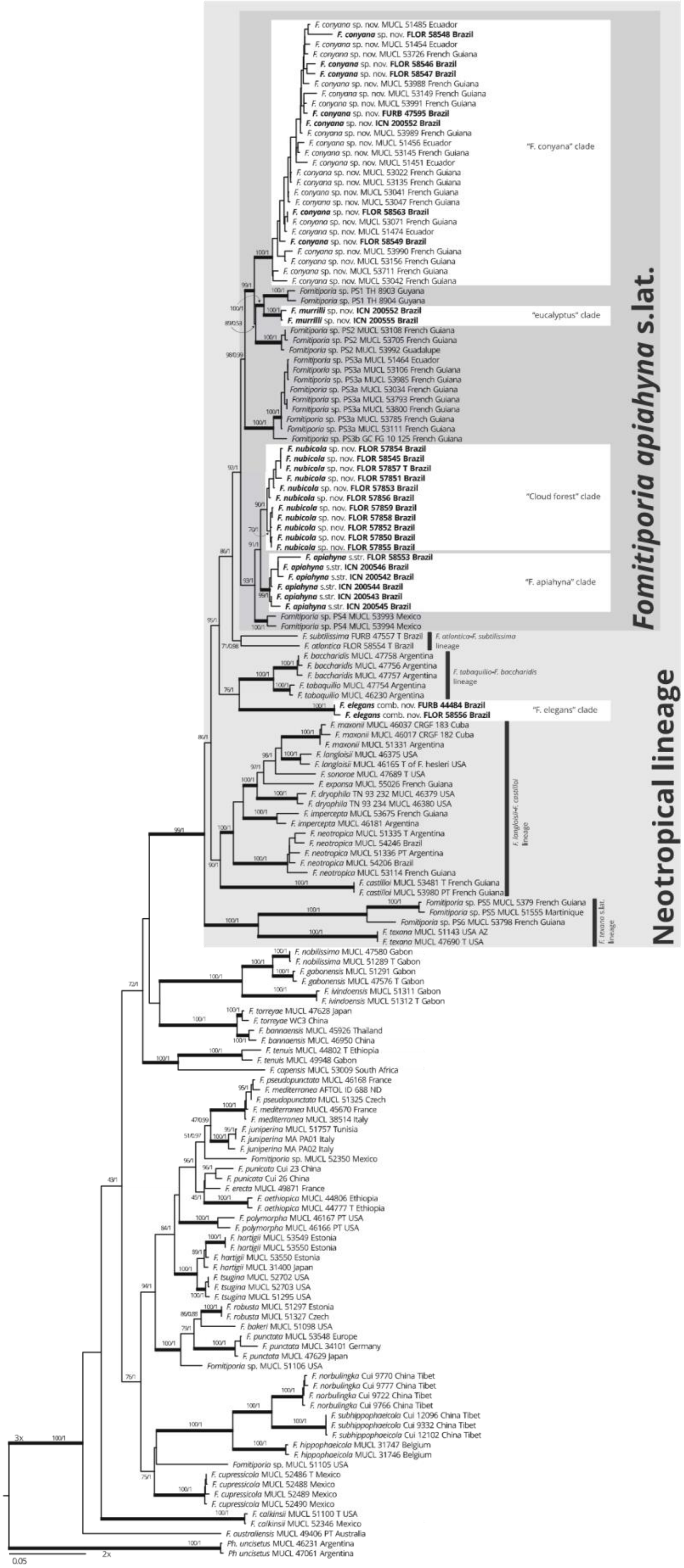
For this study, we generated 101 new sequences. The total number of positions of the final alignments, invariable positions (IP), variable parsimony-uninformative positions (VPUP), parsimony-informative positions (PIP), and all pertinent information about the 11 partitions are summarized in Table 2. The combined dataset (ITS+ncLSU+*TEF*-1α+*RPB2*) resulted in an aligned matrix of 3815 bp long (including gaps). From total characters, 2403 (63%) were IP, 219 (6%) were VPUP, and 1176 (31%) were PIP. In the Bayesian analysis, after 5,620,000 generations, the runs converged to stable likelihood values (−lnL = 28,567.58, 28,587.04). A 50% majority-rule consensus tree was computed and Bayesian posterior probabilities (BPPs) were generated for the resulting tree. The bootstopping criteria of RAxML indicated that 300 pseudoreplications were sufficient to access the internal branch support and the final ML optimization likelihood was −lnL = 28,949.65. The best-scoring ML tree and 50% majority-rule consensus tree did not show major conflicts in the tree topology and were mostly congruent, which allowed us to combine them. Only the topology from ML analysis is exhibited while both BS and BPP values are showed on the branches (Fig. 1).

The topologies resulting from both ML and BI approaches were highly supported by BS and BPP (Fig. 1). All our specimens were retrieved in the Neotropical clade sensu Amalfi and Decock (2013) (BS = 99/BPP = 1). The Neotropical *Fomitiporia* were distributed into the following clades: the *F. texana* s.l. lineage (100/1), which comprises *F. texana* and two unnamed/undescribed species; the *F. langloisii*–*F. castilloi* lineage (90/1), in all the species, have resupinate basidioma (e.g., *F. dryophila*, *F. maxonii*, and

Table 2 Summary of ITS, ncLSU, *TEF*-1α, and *RBP2* datasets

Properties	Datasets											
	ITS1	5.8S	ITS2	ncLSU	*TEF*1-1st	*TEF*1-2nd	*TEF*1-3rd	*TEF*1introns	*RPB2*-1st	*RPB2*-2nd	*RPB2*-3rd	Total
Model selected	HKY+G	K80	HKY+G	GTR+I+G	GTR+I	F81+I	GTR+G	HKY+I+G	GTR+I+G	F81+I	GTR+I+G	
Likelihood score	− 4634.17	− 365.36	− 3024.62	− 3436.77	− 718.17	− 577.42	− 3682.51	− 2163.41	− 884.07	− 520.07	− 6008.53	
Base frequencies												
Freq. A =	0.2781	Equal	0.2482	0.2585	0.2981	0.3083	0.1554	0.2908	0.2754	0.3031	0.1965	
Freq. C =	0.1800	Equal	0.1834	0.1980	0.1973	0.2523	0.3125	0.1937	0.2373	0.1904	0.1988	
Freq. G =	0.1967	Equal	0.2026	0.2949	0.3760	0.1622	0.2382	0.1539	0.3522	0.2043	0.2951	
Freq. T =	0.3451	Equal	0.3657	0.2486	0.1286	0.2772	0.2940	0.3616	0.1352	0.3021	0.3097	
Proportion of invariable sites	–	–	–	0.6364	0.8784	0.9074	–	0.0919	0.5701	0.7817	0.0564	
Gamma shape	1.0881	–	0.6091	0.6126	–	–	1.7984	7.7602	0.8089	–	1.8897	
Final DNA sequence alignments (bp)	907			897	994			204	813			3815
Invariable positions separately	414			724	705			51	509			2403
Invariable positions (%) separately	46%			81%	71%			25%	63%			
Variable parsimony-uninformative positions separately	95			41	39			17	27			219
Variable parsimony-uninformative positions (%) separately	10%			3%	4%			8%	3%			
Parsimony-informative positions separately	391			132	250			126	277			1176
Parsimony-informative positions (%) separately	43%			15%	25%			62%	34%			
Parsimony-informative positions (%) of each DNA region against total	10%			3%	7%			3%	7%			31%

Fig. 1 Phylogram from relationships of *Fomitiporia*, of combined ITS, ncLSU, *TEF*-1α, and *RPB2* sequences. Inferred by maximum likelihood analysis (log likelihood –ln 28949.65). Thicker branches represent full support (BS/BPP = 99/0.99 or higher). Sequences provided in this study are in bold



F. neotropica), but *F. castilloi* that has a pileate habit; the *F. tabaquilio*–*F. baccharidis* lineage (76/1), comprising two Andean species to which *Phellinus elegans* was recovered as sister clade; the three latter species were closely related to the *F. atlantica*–*F. subtilissima* (71/0.98) and *F. apiahyna* s.l. lineages (92/1).

In the *F. apiahyna* s.l. lineage (sensu Amalfi and Decock 2013), eight distinct lineages were recovered; *Fomitiporia* sp. PS1–4, *F. apiahyna* sensu Amalfi and Decock (2013), and three additional clades containing specimens from the type locality of *F. apiahyna*, specimens from cloud forest in Southern Brazil growing on *Drimys*, and specimens from *Eucalyptus*. The "*F. apiahyna*" clade and the "Cloud forest" clade clustered together (91/1), and form a clade sister to *Fomitiporia* sp. PS4. The "eucalyptus" clade is closely related to *Fomitiporia* PS1 and PS2 (89/0.53), and related to the "*Fomitiporia* sp. nov." (99/1).

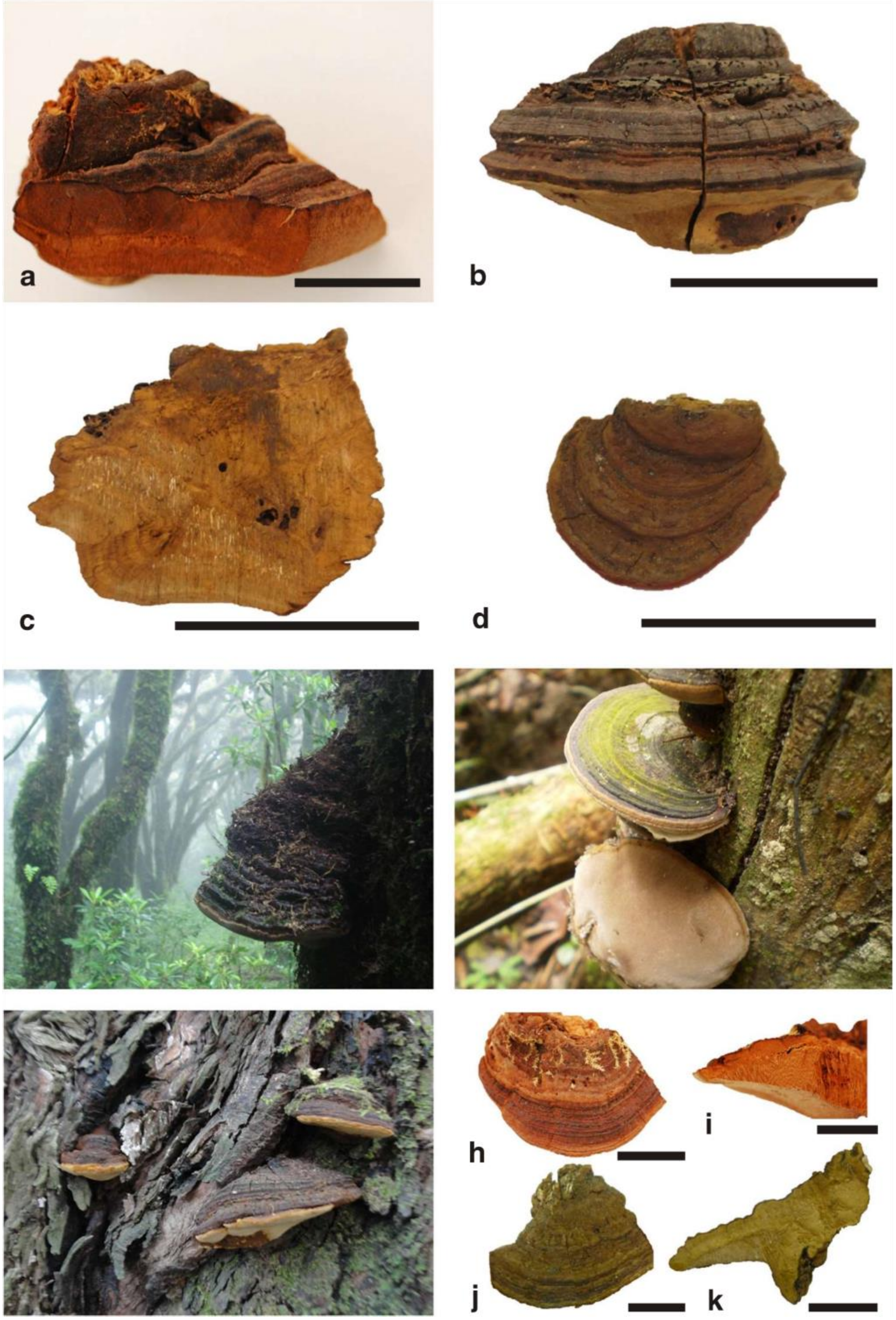


Fig. 2 Macroscopic features. **a–d** *Fomitiporia apiahyna* s.s. **a** Details of the pileus and context from the holotype (LPS24922). **b** Pileus sulcate and cracked from ICN200542. **c** Context and tubes from ICN200542. **d** Pileus sulcate from young basidioma of ICN200543. **e** *Fomitiporia nubicola* in situ (FLOR 57857), Cloud Forest in the background. **f** *Fomitiporia conyana* in situ. Pileus and pore surface from FLOR58548. **g** *Fomitiporia murrilli* in situ. Pileus, margin, and pore surface from ICN200553. **h–k** *Fomitiporia elegans*. **h–i** Pileus, context, and tubes from holotype (BAFC24382). **j–k** Pileus, context, and tubes from FLOR 58556. Bars: **a–c**, **e–g** = 5 cm; **d**, **h–k** = 1 cm

Collections and morphological analysis

Most of our collections were carried out in the Parana dominion, besides a few specimens from the Cerrado, Pampean, and Xingu-Tapajós provinces (Fig. 3). Among our collections, two specimens (ICN200542 and ICN200543) originated from Apiaí-SP, the type locality of *F. apiahyna*. The comparison of these two specimens with the type specimen of *F. apiahyna* (LPS24922) did not reveal any consistent difference; both the holotype and our new collections have a concentrically zonate pileus with broad bands, moderately to strongly sulcate, including in young basidiomata (Fig. 2b–d). On this basis, we concluded that these Apiaí specimens indeed represented *F. apiahyn*a sensu stricto (s.s.).

Given the results of our phylogenetic analyses that define several lineages previously (Amalfi and Decock 2013) or now evidenced and both morphological and ecological data, we proposed in the following (1) to redefine and in order to fix the species concept, to epitypify *F. apiahyna* s.s. based on the *F. apiahyna* s.s. lineage (Fig. 1) comprising specimens we collected mainly from Araucaria Forest province and with basidiospores averaging 5.7 × 5.3 μm; (2) *Fomitiporia nubicola* sp. nov., of which most specimens were found on living *Drimys angustifolia*, occurring in Cloud Forest of southern Brazil, with basidiospores averaging 5.7 × 5.3 μm; (3) *F. murrilli* sp. nov. comprising specimens that grow on *Eucalyptus* sp. in southern Brazil, with basidiospores averaging 6.0 × 5.3 μm; (4) *F. conyana* sp. nov. for the lineage previously proposed by Amalfi and Decock (2013) as *F. apiahyna* sensu auctores (s.a.), whose we found to be widely distributed (Fig. 3) and with basidiospores averaging 4.9 × 4.4 μm (Fig. 4, Table S1); and (5) *Fomitiporia elegans* comb nov. for *Phellinus elegans*, with basidiospores averaging 6.2 × 5.5 μm (Fig. 4).

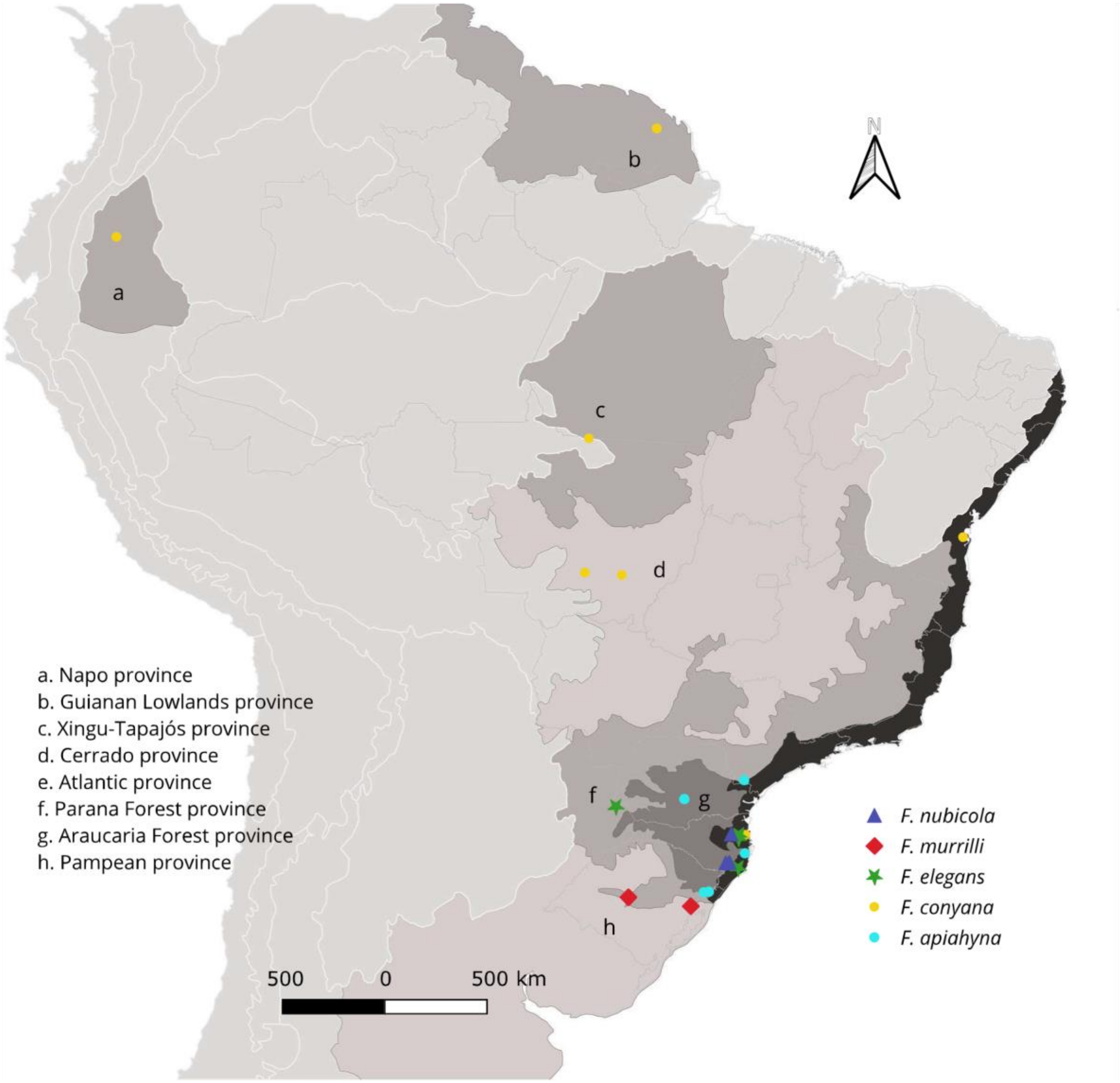


Fig. 3 Distribution map of *F. apiahyna, F. conyana*, *F. elegans*, *F. nubicola*, and *F. murrilli*. White polygons are the delimitations of provinces provided by Morrone (2014)

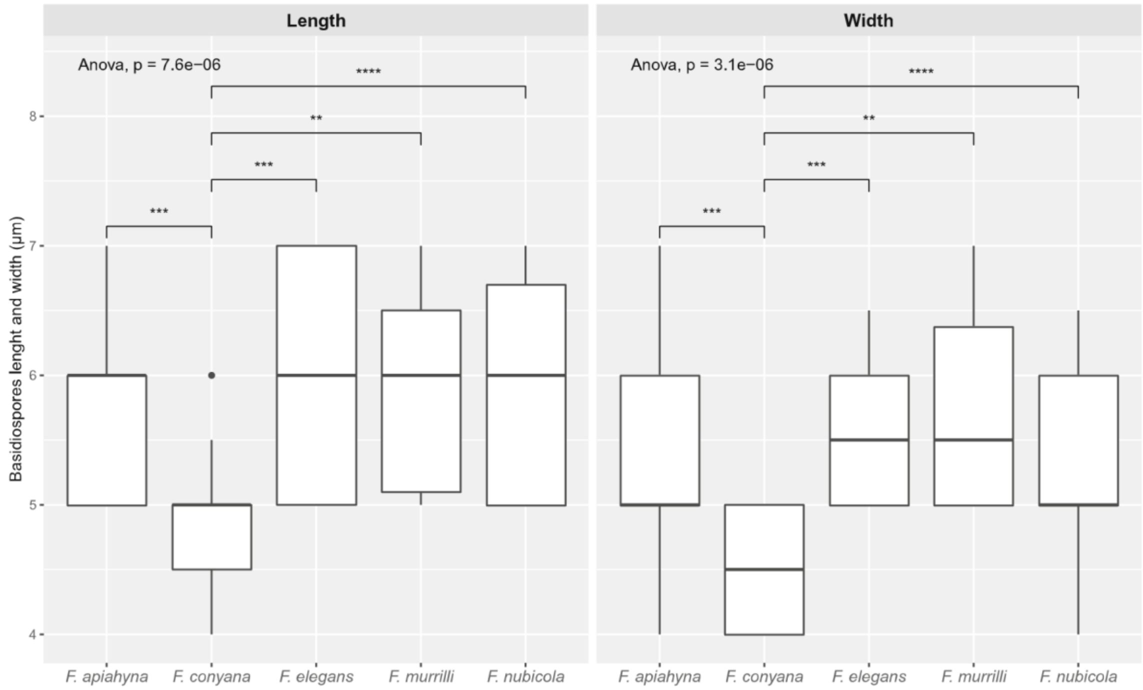


Fig. 4 Boxplot graphic based on length and width of basidiospores in range. For each taxon 25–75% quartiles are drawn using a box, median is shown with a horizontal line inside the box. The intervals represented by a dashed line correspond to the largest value less than 1.5 times the box height and the smallest value less than 1.5 times the box height. Values outside these intervals are considered outliers and are represented as circles. * ≤ 0.05, ** ≤ 0.01, *** ≤ 0.001, **** ≤ 0.0001

Taxonomy

Fomitiporia apiahyna (Speg.) Robledo, Decock & Rajchenb., Mycologia 102: 1315 (2010); Figs. 1, 2a–d, 3, 4.

MycoBank: MB516533.

Basionym: *Fomes apiahynus* Speg., Boln Acad. Nac. Cienc. Córdoba 11: 438 (1889).

≡ *Phellinus apiahynus* (Speg.) Rajchenb. and J.E. Wright, Mycologia 79: 251 (1987).

≡ *Fomitiporia apiahyna* (Speg.) Vlasák and Kout, in Vlasák, Kout, Vlasák and Ryvarden, Mycotaxon 118: 161 (2011), illegitimate.

Holotype: Brazil: São Paulo, Apiaí, growing on old trunk, May 1881, leg. J. I. Puiggari 1438 (LPS24922!).

Epitype: Brazil: São Paulo, Apiaí, Parque Natural Municipal Morro do Ouro, 24° 31′ 18.9″ S, 48° 50′ 04.7″ W, 840 m asl, on dead standing unidentified angiosperm, 6 Feb. 2018, leg. G. Alves-Silva 1270 (ICN200542).

Description: *Basidiomata* perennial, pileate, sessile, solitary, elliptical, semicircular to slightly dimidiate from above, rarely pendant, triquetrous to obtriquetrous in section, occasionally with a basal umbo, projecting 19–220 mm, 30–200 mm wide and 16–63 mm thick at the base, hard corky to woody consistency; *pileus* glabrous, concentrically zonate with broad, large bands near the base to multiple narrow bands toward margin, moderately to strongly sulcate, radially cracked with age, sometimes covered by mosses, dull, upon drying golden brown [5 D(6–8)], brown [5 F(4–8)], dark brown [8 F(7–8)] to black; sterile *margin* thick, obtuse, rounded, slightly folded, rarely acute, when young well delimited from the pore surface, light brown, yellowish brown, golden brown [5 D(5–8)]; *pore surface* light grayish brown (5D8), brownish gray, grayish brown [5 F(2–4)] to cinnamon; *pores* round to angular, (5)6–8 per millimeter, (80)90–210(240)-µm diam. (ave = 147 µm); *dissepiments* entire, (30)40–140(170) µm (ave = 74 µm) thick; *tubes* distinct to indistinctly stratified, mostly up to 10 layers, with up to 18 layers in the older basidioma, individual tube layers up to 4.5 mm tall, with evident interleaved context in the older layers, brown to grayish brown [5 EF (3–4)], the older layers filled with whitish mycelium; *context* homogeneous, up to 11 mm thick at the base, concentrically zonate, with a dense texture and woody consistency, light brown [6 D(6–8)] to yellowish brown [5 D(7–8)], sometimes with extremely thin black lines (invisible to the naked eye) mainly near the pilear surface.

Hyphal system dimitic in all parts; *generative hyphae* simple septate, hyaline to pale yellow, sparingly branched, 2–3-µm diam.; *skeletal hyphae* yellowish brown to reddish brown, unbranched, thick-walled, in the context (3)3.5–5(6.5)-µm diam., with local swellings up to 10 µm, the lumen (1)1.5–5(6) µm wide, in the hymenophoral trama 3–5(6)-µm diam., the lumen 1–3(4) µm wide. *Hymenium*: *hymenial setae* absent; *cystidioles* fusoid, lanceolate, hyaline, thin-walled; *basidia* subglobose to globose, hyaline, tetrasporic, (8)9–11(13) × (5)7–9(9.5) (ave = 9.4 × 8.9 µm) $Q = 1–1.5$ µm ($Qm = 1.2$ µm); *basidioles* identical in shape but slightly smaller than basidia; *basidiospores* subglobose to globose, 5–6.5(7) × (4)5–6(7) µm (ave = 5.7 × 5.3 µm) *Q* = 1–1.2(1.3) µm (*Q*m = 1.06 µm), hyaline, strongly dextrinoid, cyanophilous, thick-walled, smooth; *crystals* rhomboid, of variable size.

Physiology, substrate, habitat, and known distribution: white-rot fungus, dead standing trees (e.g., Lauraceae, Myrtaceae), Araucaria Forest province (at 800–1000 m asl) in Paraná and Rio Grande do Sul states, Atlantic province in Santa Catarina state and Parana Forest province in São Paulo state, Brazil.

Specimens examined: Brazil—São Paulo, Apiaí, Parque Natural Municipal Morro do Ouro, 24° 31′ 18.6″ S, 48° 50′ 04.3″ W, 899 m asl, on living *Ocotea* sp., 9 Feb. 2018, leg. G. Alves-Silva 1311 (ICN200543); ibid., Paraná, Guarapuava, Parque Municipal das Araucárias, 25° 21′ 10″ S, 51° 28′ 13″ W, 1070 m asl, on dead standing unidentified angiosperm, 22 Feb. 2017, leg. V. Oliveira-Garcia 111 (ICN200544); ibid., Rio Grande do Sul, São Francisco de Paula, Floresta Nacional de São Francisco de Paula, at the base of living unidentified angiosperm, Myrtaceae, 26 Nov. 2016, leg. G. Alves-Silva 977 (ICN200545); ibid., 29° 25′ 18.6″ S, 50° 23′ 24.7″ W, 913 m asl, on roots of a dead fallen trunk, unidentified angiosperm, 26 Nov. 2016, leg. G. Alves-Silva 979 (ICN200546); ibid., Hotel Veraneio Rampel, 29° 26′ 38″ S, 50° 36′ 50″ W, 900 m asl, on living unidentified angiosperm, 25 Jun. 2017, leg. V. Oliveira-Garcia 158 (ICN200547); ibid., Santa Catarina, Santo Amaro da Imperatriz, Trilha do hotel Caldas da Imperatriz, 27° 44′ 04.11″ S, 48° 48′ 21.44″ W, on dead stump, 15 Nov. 2013, leg. E.R. Drechsler-Santos 1288 (FLOR58553).

Notes: *Fomitiporia apiahyna* s.s. is characterized by pileate basidiomata with a strongly concentrically sulcate pileus, with broad bands, a thick context (up to 11 mm), and tiny pores (6–8/mm, ave. = 6.8). Microscopically, basidiospores are in the range of 5–6.5(7) × (4)5–6(7) µm, averaging 5.7 × 5.3 µm. Concerning hosts and habitat, *F. apiahyna* specimens were found on several hosts from the Araucaria Forest province (Fig. 3).

Phylogenetically (Fig. 1), our specimens from the type locality formed a clade distinct from the *F. apiahyna* sensu Amalfi and Decock clade (Amalfi and Decock 2013). Additionally, our specimens that were recovered in the *F. apiahyna* sensu Amalfi and Decock clade have morphological differences from those that we consider here as *F. apiahyna* s.s., which we proposed below as new.

Fomitiporia conyana Alves-Silva & Drechsler-Santos, sp. nov., Figs. 1, 2f, 3, 4.

MycoBank: MB835299.

Etymology: "*conyana*," in honor to Dr. Cony Decock for his important contribution as taxonomist and especially for his critical studies on hymenochaetoid fungi.

Holotype. Brazil: Mato Grosso, Primavera do Leste, Área de Proteção Permanente, IMAmt, near to Córrego Alminhas, 15° 31′ 17.16″ S, 54° 12′ 23.31″ W, on dead standing trunk, unidentified angiosperm, 12 Nov. 2013, leg. G. Alves-Silva 738 (FLOR 58548).

Description: *Basidiomata* perennial, pileate, sessile, solitary or gregarious, then emerging in groups, semicircular in outline, rarely pendant, triquetrous, obtriquetrous to ungulate in section, occasionally with a basal umbo, projecting 12–86 mm, 14–122 mm wide, 10–76 mm thick at the base, hard corky to woody consistency; *pileus* glabrous, slightly convex, concentrically zonate with multiple narrow bands, sometimes interleaved with broad bands and moderated sulcus, radially cracked when dried and old, light brown [6 D(5–8)], brown [6 E(5–8)] to dark brown [6 F(5–8)] becoming black; *margin* acute to rounded, slightly folded, sometimes thick, sterile, brownish yellow [5 C(7–8)], yellowish brown 5D8; *pore surface* grayish brown (5E3) when young then brown 5E4, grayish brown [6 EF(3)] to cinnamon; *pores* round to angular, 6–8(9) per millimeter, (50)100–220(240)-µm diam. (ave = 114 µm); *dissepiments* entire, (20)30–120(130) µm (ave = 59 µm) thick; *tubes* distinctly stratified, with up to 10 layers, interleaved with thin layer of context, each individual layer up to 3 mm tall, light brown, brown [5 DE (5–8)], to grayish brown (5E3), the older layers filled with whitish mycelium; *context* homogeneous, up to 7.5 mm thick at the base, concentrically zonate, with dense texture and woody consistency, golden to brownish yellow [5 BC (7–8)], with a distinct dark line at the surface mainly seen in younger basidiomata.

Hyphal system dimitic in all parts; *generative hyphae* simple septate, hyaline to pale yellow, sparingly branched, (1)1.5–2.5(3)-µm diam.; *skeletal hyphae* golden brown to reddish brown, unbranched, thick-walled, in the context 3–5(5.5)-µm diam., rarely with local swelling up to 8 µm, the lumen (1)1.5–3 µm wide, in the hymenophoral trama (3)3.5–5(6)-µm diam., the lumen (1.5)2–3(4) µm wide. *Hymenium*: *hymenial setae* absent; *cystidioles* fusoid, lanceolate, hyaline, thin-walled; *basidia* subglobose to globose, hyaline, tetrasporic, (7)7.5–10(11) × (6.5)7–8(9) (ave = 8.6 × 7.0 µm) *Q* = 1–1.3 µm (*Q*m = 1.16 µm); *basidioles* identical in shape but slightly smaller than basidia; *basidiospores* subglobose to globose, (4.5)5–5.5(6) × 4–5(6) µm (ave = 4.9 × 4.4 µm) *Q* = 1.0–1.3(1.42) µm (*Q*m = 1.12 µm), hyaline, strongly dextrinoid, cyanophilous, thick-walled, smooth.

Physiology, substrate, habitat, and known distribution: white-rot fungus, mostly dead trunk (standing, fallen), Atlantic province in Santa Catarina and Bahia states, Cerrado and Xingu-Tapajós provinces in Mato Grosso state, Ecuador in the Napo province, and French Guiana in the Guianan Lowlands province.

Additional specimens examined: Brazil: Mato Grosso, Cuiabá, Parque Nacional de Chapada dos Guimarães, Sítio Véu de Noiva, 15° 24′ 23.19″ S, 55° 50′ 12.14″ W, at the base of living unidentified angiosperm, 27 Dec. 2016, leg. G. Alves-Silva 998 (ICN200548); ibid., at the base of dead trunk, 27 Dec. 2016, leg. G. Alves-Silva 1007 (ICN200549); ibid., Primavera do Leste, Área de Proteção Permanente, IMAmt, Córrego Alminhas, 15° 31′ 17.16″ S, 54° 12′ 23.31″ W, on dead standing trunk, 22 Dec. 2013, leg. G. Alves-Silva 559 (FLOR 58563); ibid., 10 Feb. 2014, leg. G. Alves-Silva 737 (FLOR 58546); ibid., leg. G. Alves-Silva 742 (FLOR 58547), ibid., at the base of living unidentified angiosperm, 29 Dec. 2016, leg. G. Alves-Silva 1025 (ICN200550); ibid., Novo Mundo, Parque Estadual Cristalino, Parcelas PPBio, 9° 30′ 49.04″ S, 55° 39′ 25.75″ W, 11 Mar. 2015, leg D. Batistella 2-21 (FLOR 58549); ibid., Santa Catarina, Blumenau, Parque Natural Municipal São Francisco de Assis, 26° 55′ 17″ S, 49° 04′ 18″ W, at the base of living unidentified angiosperm, 15 Sep. 2015, leg. F. Bittencourt 511 (FURB 47595); ibid., Rio Grande do Sul, Porto Alegre, Morro Santana, UFRGS, 30° 03′ 49.7″ S, 51° 07′ 29.8″ W, on dead standing trunk, 21 Oct. 2016, leg. G. Alves-Silva 972 (ICN200551); ibid., Bahia, Igrapiúna, Reserva Ecológica da Michelin, 13° 50′ 59.8″ S, 39° 13′ 44.3″ W, on dead standing trunk, 21 Sep. 2016, leg. M. Comin 60 (ICN200552).

Notes: *Fomitiporia conyana* is mainly characterized by having perennial, triquetrous basidiomata, an acute to round margin, moderately concentrically sulcate pilei, and basidiospore averaging 4.9 × 4.4 µm, rarely reaching 6 µm long (Fig. 4, Table S1). *Fomitiporia apiahyna* s.s. is the closest morphological relatives, it differs mainly by having larger basidiospores, averaging 5.7 × 5.3 µm, reaching up to 7 µm in the longest and widest dimensions. *Fomitiporia conyana* has an ample distribution, found in various spots of in Brazil, Ecuador, and French Guiana, whereas *F. apiahyna* is mostly found in the Araucaria Forest province and Atlantic province (Fig. 3).

Fomitiporia nubicola Alves-Silva, Bittencourt & Drechsler-Santos, sp. nov., Figs. 1, 2e, 3, 4.

MycoBank: MB835300.

Etymology: "*nub*" (from Latin) = a cloud + "*–col*" (from Latin) = dwell, indicating an inhabitant; it means that the habitat of new species is Cloud Forest.

Holotype: Brazil: Santa Catarina, Urubici, Parque Nacional de São Joaquim, 28° 07′ 13.5″ S, 49° 29′ 31.2″ W, 1700 m asl, growing on living *Drimys angustifolia* species tree, 31 Oct. 2014, leg. G. Alves-Silva 630 (FLOR 57850).

Description: *Basidiomata* perennial, pileate, sessile, rarely broadly attached, solitary, semicircular in outline, ungulate, triquetrous, obtriquetrous to bell shaped in section, occasionally with a basal umbo, projecting 20–145 mm, 25–190 mm wide, 21–201 mm thick at the base, hard corky to woody consistency; *pileus* glabrous, concentrically zonate with multiple broad bands, sulcate, radially cracked mainly when old and dried, light brown [6 D(5–8)] to brown [6 E(5–8)] becoming dark brown [6 F(5–8)] to black from t e base; sterile *margin* rounded, slightly folded (sometimes with incomplete deposition near to pileus), thick, pale yellow to light yellow [4 A(3–5)] in young specimens, then golden yellow (5B7) to brownish yellow [5 C(7–8)] or yellowish brown [5 D(6–8)] on aging; *pore surface* grayish brown, brownish beige (6E3) to cinnamon when older; *pores* round to angular, (5)6–8(9)/mm, (90)100–150(170)-µm diam. (ave = 120 µm); *dissepiments* entire, (30)50–110(130) µm (ave = 60 µm) thick; *tubes* distinctly stratified, with up to 22 distinct layers, individual layers up to 6 mm tall, interleaved with thin layer of context, on drying are disjoined, light brown to brown [6 DE (6–8)], but youngest (active) layer grayish brown (6E4) to cinnamon, oldest layers filled with whitish mycelium; *context* homogenous, zonate, up to 12 mm thick at the base, with dense texture and woody consistency, golden to brownish yellow [5 BC (7–8)], with a thin black line on the surface.

Hyphal system dimitic in all parts; *generative hyphae* simple-septate, hyaline to pale yellow, sparingly branched, 2–3-µm diam.; *skeletal hyphae* golden brown to reddish brown, unbranched, thick-walled, 3–6-µm diam., occasionally with local swellings, the lumen 1.5–4 µm wide in the context, 3–4-µm diam., the lumen 1–2 µm wide in the hymenophoral trama. *Hymenium*: *hymenial setae* absent; *cystidioles* clavate, fusoid, lanceolate, hyaline, thin-walled; *basidia* subglobose to globose, hyaline, tetrasporic, 8–10(11) × (7)7.5–9(10) µm, (ave = 9.4 × 8.6 µm), *Q* = 1–1.25(1.33) µm, (*Q*m = 1.1 µm); *basidioles* identical in shape but slightly smaller than basidia; *basidiospores* subglobose to globose, 5–6(7) × (4)5–6(6.5) µm, (ave = 5.9 × 5.4 µm), *Q* = 1–1.25(1.3) µm, (*Q*m = 1.09 µm), hyaline, strongly dextrinoid and cyanophilous, thick-walled, smooth; *crystals* rhomboid, of variable size.

Physiology, *substrate*, *habitat*, *and known distribution:* white-rot fungus, living and dead standing trunk, *Drimys* sp., mostly *D. angustifolia* (Winteraceae), among mosses, currently known from altitudinal Cloud Forest, mostly at 1500–1720 m asl, Serra Geral, Araucaria Forest province, but also at 850 m asl in Serra de Itajaí, Rodeio, Atlantic province, Santa Catarina state, Brazil.

Additional specimens examined: Brazil—Santa Catarina, Urubici, Parque Nacional de São Joaquim, Santa Barbara, RAPELD module I, 28° 09′ 18.1″ S, 49° 38′ 24.1″ W, 1,500 m asl, on living *Drimys angustifolia*, 4 Mar. 2014, leg. E.R. Drechsler-Santos 1336 (FLOR 57853); ibid., 21 Jun. 2014, leg. G. Alves-Silva 608 (FLOR 57851); ibid., 04 Dec. 2014, leg. G. Alves-Silva 659 (FLOR 57852); ibid., on dead standing trunk, 24 Nov. 2011, leg. E. R. Drechsler-Santos 634 (FLOR 58599); ibid., on dead standing trunk, 20 Oct. 2013, leg. C. Salvador-Montoya 549 (FLOR 58532); ibid., on dead standing trunk, 20 Jun. 2014, leg. G. Alves-Silva 591 (FLOR 58535); ibid., leg. G. Alves-Silva 597 (FLOR 58536); ibid., on dead standing trunk, 4 Dec. 2014, leg. G. Alves-Silva 660 (FLOR 58533); ibid., leg. M.A. Reck

933 (FLOR 58529); ibid., near to RAPELD module II, 28° 07′ 13.5″ S, 49° 29′ 31.2″ W, 1,720 m asl, on dead standing trunk of *D. angustifolia*, 31 Oct. 2014, leg. G. Alves-Silva 632 (FLOR 57854); ibid., leg. G. Alves-Silva 629 (FLOR 58543); ibid., leg. G. Alves-Silva 631 (FLOR 58541); ibid., 26 Nov. 2014, leg. G. Alves-Silva 647 (FLOR 57855); ibid., leg. G. Alves-Silva 649 (FLOR 57856); ibid., leg. G. Alves-Silva 650 (FLOR 57857); ibid., leg. G. Alves-Silva 651 (FLOR 57858); ibid., leg. G. Alves-Silva 652 (FLOR 58544); ibid., leg. G. Alves-Silva 654 (FLOR 58542); ibid., leg. G. Alves-Silva 655 (FLOR 57859); ibid., leg. G. Alves-Silva 656 (FLOR 58540); ibid., near to Morro da Igreja, on dead standing trunk of *D. angustifolia*, 26 Nov. 2014, leg. G. Alves-Silva 648 (FLOR 58545); ibid., on dead standing trunk, 20 Oct. 2013, leg. C. Salvador-Montoya 544 (FLOR 58530); ibid., leg. C. Salvador-Montoya 546 (FLOR 58539); ibid., leg. C. Salvador-Montoya 547 (FLOR 58537); ibid., leg. C. Salvador-Montoya 548 (FLOR 58592); ibid., Rodeio, Eremitério Beato Frei Egídio, 26° 52′ 41.0″ S, 49° 24′ 02.0″ W, 850 m asl, on dead standing *Drimys* sp. trunk, 23 Sep. 2016, leg. F. Bittencourt 845 (FURB 52808).

Notes: *Fomitiporia nubicola* is mainly characterized by perennial, semicircular, ungulate, triquetrous, or obtriquetrous, to bell-shaped basidiomata. The largest basidioma comprises more than 22 tube layers (Fig. 2e). Pilei have broad bands, sulcate, and become radially cracked on aging and on drying. Microscopically, basidiospores measure on average 5.9 × 5.4 µm.

Macro- or micromorphological features are poorly discriminative in *Fomitiporia*, particularly within the *F. apiahyna* complex (Vlasák and Kout 2011; Amalfi and Decock 2013). However, *F. nubicola* has eco-geographical particularities that distinguish it from other taxa. *Fomitiporia apiahyna* was found mostly in the Araucaria Forest province (Fig. 3), at elev. 800–1000 m asl, growing on, e.g., Lauraceae and Myrtaceae. *Fomitiporia nubicola* was found growing mostly on *D. angustifolia* and also on a *Drimys* sp. (Winteraceae) in the Cloud Forest (mostly at 1500–1720 m asl, down to 850 m asl (FURB52808, confirmed by ITS tree, data not shown). It has a rather narrow distribution range.

Moreover, morphologically, *F. apiahyna* has basidiospores up to 7 µm wide and the number of pores/millimeter does not exceed 8, unlike *F. nubicola*, whose basidiospores are up to 6.5 µm wide and the number of pores/millimeter up to 9. Finally, *F. conyana* differs from *F. nubicola* mainly by having smaller basidiospores (averaging 4.9 × 4.4 µm vs. 5.9 × 5.4 µm, Fig. 4) and distinct ecological requirements (cf. above).

Fomitiporia murrilli Alves-Silva, R.M. Silveira & Drechsler-Santos, sp. nov., Figs. 1, 2g, 3, 4.

MycoBank: MB835301.

Etymology: "*murrilli*," named in honor of William Alphonso Murrill, due to his contribution to mycology, mainly concerning polypores fungi and by the authorship of *Fomitiporia* genus.

Holotype: Brazil: Rio Grande do Sul, Santa Maria, FEPAGRO, 29° 39′ 47.1″ S, 53° 54′ 52.2″ W, approx. 100 m asl, growing on living *Eucalyptus* sp. tree, 01 Aug. 2017, leg. G. Alves-Silva 1199 (ICN200553).

Description: *Basidiomata* perennial, pileate, sessile, elliptical, semicircular, in outline, sometimes asymmetric ellipse observed from attached point, moderately ungulate, triquetrous to obtriquetrous in section, occasionally with a basal umbo, projecting 25–84 mm, 33–97 mm wide and 42–61 mm thick at the base, hard corky to woody consistency; *pileus* glabrous, concentrically zonate with multiple round to acute broad bands, moderately to strongly sulcate, radially cracked, sometimes covered by mosses, brownish yellow [5C (7–8)], brown [5 F(4–8)], reddish brown to dark brown [8 F(4–8)]; *margin* rounded, slightly folded, sterile, slightly velutinous, pale yellow to light yellow [4 A(3–5)] in young specimens, deep yellow (4A8), golden yellow (5B7) to brownish yellow [5 C(7–8)] or yellowish brown [5 D(6–8)]; *pore surface* brown [6E (4–5)], grayish brown (6F3), brownish beige (6E3) to cinnamon; *pores* round to angular, (4)5–7(8) per millimeter, (100)110–220(216)-µm diam. (ave = 150 µm); *dissepiments* entire, (30)40–180(200) µm (ave = 85 µm) thick; *tubes* distinctly stratified, with up to 3 distinct layers, individual layers up to 9 mm tall, interleaved with thin layer of context, light brown to brown [6 DE (6–8)], but youngest (active) layer grayish brown (6E4) to cinnamon, the older layers filled with whitish mycelium; *context* homogeneous, zonate, up to 6 mm thick, with dense texture and woody consistency, golden to brownish yellow [5 BC (7–8)], distinct dark line at the surface in younger layers and remarkable crust when older.

Hyphal system dimitic in all parts; *generative hyphae* simple septate, hyaline to pale yellow, sparingly branched, 2–3-µm diam.; *skeletal hyphae* golden brown to reddish brown, unbranched, thick-walled, in the context 3–4(5)-µm diam., occasionally with local swelling, the lumen 1–3 µm wide, in the hymenophoral trama (3)3.5–5-µm diam., the lumen (1)2–3 µm wide; hyphae in the dissepiments thick-walled and yellowish ending thin-walled and hyaline. *Hymenium*: *hymenial setae* absent; cystidioles fusoid, lanceolate, hyaline, thin-walled; *basidia* subglobose to globose, hyaline, tetrasporic, 9–10 × (7)7.5–9(10) (ave = 9.8 × 8 µm) $Q = 1–1.3$ µm ($Qm = 1.2$ µm); *basidioles* identical in shape but slightly smaller than basidia; *basidiospores* subglobose to globose, 5–6(7) × 5–6(7) µm (ave = 6.0 × 5.3 µm) $Q = 1–1.2$ µm ($Qm = 1.14$ µm), hyaline, strongly dextrinoid and cyanophilous, thick walled, smooth; *crystals* rhomboid, of variable size.

Physiology, *substrate*, *habitat*, *and known distribution*: white-rot fungus, living and dead standing trunk, *Eucalyptus* sp., currently known from Parana Forest and Pampean provinces in Rio Grande do Sul state, southern Brazil.

Additional specimens examined: Brazil: Rio Grande do Sul, Porto Alegre, Jardim Botânico de Porto Alegre, 30° 3′ 1.9″ S, 51° 10′ 34.6″ W, on standing dead unidentified angiosperm, 27 Jan. 2017, leg. V. Oliveira-Garcia 99 (ICN200555); ibid., leg. V. Oliveira-Garcia 100 (ICN200556); ibid., at the base of living *Eucalyptus* sp., 8 Sep. 2018, leg. G. Alves-Silva 1333 (ICN200554).

Notes: *Fomitiporia murrilli* is characterized mainly by having concentric zonation, moderately sulcate, radially cracked pileus (Fig. 2g), reddish brown to black pilear surface, pores (4)5–7(8) per millimeter, and basidiospores 5–6(7) × 5–6(7) µm, on average 6.0 × 5.3 µm. *Fomitiporia murrilli* was shown as a distinct clade in phylogenetic inference (Fig. 1) emerging as a new species also because its apparently particular host. The species is known so far from two specimens (ICN200553, ICN200555) found growing on *Eucalyptus* sp., in distant anthropized areas (approx. 100 m asl; Fig. 3). *Fomitiporia murrilli* should be compared to *F. apiahyna* and *F. nubicola* but differs mainly by having singular eco-geographical features. *Fomitiporia apiahyna* was found growing on living trees, e.g., *Ocotea* sp., and *F. nubicola* on living and dead *Drimys* sp. (more details cf. above). *Fomitiporia conyana* differs from *F. murrilli* mainly by having smaller basidiospores (on average 4.9 × 4.4 µm vs. 6.0 × 5.3 µm, respectively; Fig. 4), occurring in the lowland rainforest and diversified ecological requirements, with *F. conyana* found widely distributed.

Fomitiporia elegans (J.E. Wright and Blumenf.) Alves-Silva, Robledo and Drechsler-Santos, comb. nov., Figs. 1, 2h–k, 3, 4.

MycoBank: MB835302.

Basionym: *Phellinus elegans* J.E. Wright and Blumenf., Mycotaxon 21: 418 (1984).

Holotype: Argentina: Misiones, Parque Nacional Iguazú, Cataratas, on wood *Ocotea* sp., leg. Wright, Deschampset Del Busto, 27 Oct. 1973 (BAFC 24382).

Description: *Basidiomata* perennial, pileate, sessile, occasionally broadly attached, semicircular in outline, applanate, obtriquetrous to triquetrous in section, projecting 12–40 mm, 18–72 mm wide and 8–21 mm thick at the base, soft corky to woody consistency; *pileus* glabrous, infrequently convex, concentrically zonate with multiple narrow bands, faintly sulcate, light brown [6 D(6–8)], brown [6 E(6–8)] to dark brown [6 F(6–8)] becoming black near the base; *margin* acute to obtuse, rounded, slightly folded, thick, sterile, deep yellow (4A8) when young, golden yellow [5 B(6–8)], golden brown, light brown [5 D(6–8)] to brown [5 E(6–8)] on aging; *pore surface* brownish gray [5 EF(2)] to grayish brown [5 EF(3)]; *pores* round to angular, (6)7–9(10) per millimeter, (70)80–130(150)-µm diam. (ave = 97 µm); *dissepiments* entire, (30)40–100(130) µm (ave = 62 µm) thick; *tubes* distinctly stratified, with up to 7 layers, interleaved wit thin layer of context, individual tube layers up to 3 mm all, ever incomplete covering, layer after layer, brownish gray [5 EF(2)], grayish brown [5 EF(3)] to brown [5 EF(4)], the older layers filled with whitish mycelium; *context* homogeneous, up to 7 mm thick, concentrically zonate, with dense texture and woody consistency, golden to brownish yellow [5 BC (7–8)], with a distinct dark line at the surface, rarely projecting toward context.

Hyphal system dimitic in all parts; *generative hyphae* simple septate, hyaline to pale yellow, sparingly branched, 2–3(4)-µm diam.; *skeletal hyphae* golden brown to reddish brown, unbranched, thick-walled, in the context 4–6.5(7)-µm diam., occasionally with local swelling up to 9 µm, the lumen (1.5)2–5(6) µm wide, in the hymenophoral trama 3–6.5(7)-µm diam., the lumen 1–4(5) µm wide. *Hymenium*: *hymenial setae* absent; cystidioles fusoid, lanceolate, hyaline, thin-walled; *basidia* subglobose to globose, hyaline, tetrasporic, (7.5)8–10(11) × 7–9 (ave = 9.5 × 8.1 µm) Q = 1–1.2(1.4) µm (Qm = 1.17 µm); *basidioles* identical in shape but slightly smaller than basidia; *basidiospores* subglobose to globose, (5)6–7 × 5–6.5 µm (ave = 6.2 × 5.5 µm) Q = 1–1.2(1.4) µm (Qm = 1.13 µm), hyaline, strongly dextrinoid, cyanophilous, thick-walled, smooth.

Physiology, *substrate*, *habitat*, *and known distribution:* white-rot fungus, living and dead standing trunk, *Ocotea* sp. (holotype) and unidentified ones, currently known from Atlantic province in Santa Catarina state, and southern Brazil and Parana Forest province in Misiones, northeastern Argentina.

Specimens examined: Argentina: Misiones, Parque Nacional Iguazú, Cataratas, on wood *Ocotea* sp., leg. Wright, Deschamps and Del Busto, 27 Oct. 1973 (holotype BAFC 24382). Brazil: Santa Catarina, Blumenau, Parque Nacional Serra do Itajaí, Trilha da chuva, 27° 03′ 34.25″ S, 49° 04′ 57.22″ W, on dead standing trunk, 21 Nov. 2014, leg. G. Alves-Silva 642 (FLOR 58556); ibid., Parque Natural Municipal São Francisco de Assis, 26° 55′ 17.4″ S, 49° 04′ 18.62″ W, on dead trunk, 14 Aug. 2014, leg. F. Bittencourt 157 (FURB 44484); ibid., Tubarão, Rio do Pouso Alto, Fazenda Lunard, Trilha do rio, 28° 22′ 21.4″ S, 49° 05′ 57.5″ W, 02 Feb. 2013, leg. A.G.S. Silva-Filho 56 (FLOR 58570).

Notes: *Fomitiporia elegans* is characterized mainly by having thin, applanate basidiomata, up to 72 mm wide and 21 mm thick, a concentrically zonate pileus with multiple narrow bands in brown tones, hymenophore with 6–9(10) pores/millimeter. Microscopically, it has basidiospores measuring (5)6–7 × 5–6.5 µm, on average 6.2 × 5.5 µm. *Phellinus elegans* was first described by Wright and Blumenfeld (1984) but was later synonymized to *Phellinus apiahynus* (≡ *Fomitiporia apiahyna*) (Rajchenberg and Wright 1987). However, *F. apiahyna* s.s. differs in having bigger basidiomata and slightly smaller basidiospores, averaging 5.7 × 5.3 µm. Moreover, *F. apiahyna* s.s. has broad bands and a sulcate black pileus. *Fomitiporia apiahyna* and *F. elegans* also are phylogenetically distant (Fig. 1); *Fomitiporia elegans* is unrelated to *F. apiahyna* s.l. and forms a clade sister to the *F. baccharidis–F. tabaquilio* lineage. When compared with *F. apiahyna* s.l. species, *F. elegans* has the smallest basidiomata and the largest basidiospores. It also differs from *F. nubicola*, which has a specific habitat and host. *Fomitiporia conyana* has smaller basidiospores (on average 4.9 × 4.4 μm vs. 6.22 × 5.53 μm, Fig. 4), and *F. murrilli* has slightly bigger pores (4)5–7(8)/mm (diam. ave. = 150.5 μm) vs. (6)7–9(10)/mm (diam. ave. = 97.5 μm).

Key to Neotropical pileate Fomitiporia species

1 Hymenial setae present.. 2
1* Hymenial setae absent.. 3
2(1) Basidiospores 7–9 μm long, on average 7.8 × 7 μm (Gilbertson 1979; BPI892681!)..............................*F. texana*
2* Basidiospores 5.5–7 μm long, on average 6.2 × 5.2 μm (Amalfi and Decock 2013).................................. *F. castilloi*
3(1) Species occurring in high Andean ecosystems.............. 4
3* Species found outside of high Andean ecosystems.......... 5
4(3) Basidiomata cushion-shaped to pseudopileate; growing on *Polylepis* spp. (Urcelay et al. 2000)............ *F. tabaquilio*
4* Basidiomata pileate to occasionally effused-reflexed; growing on different host, e.g., *Baccharis oblongifolia* (Amalfi et al. 2014).. *F. baccharidis*
5(3) Basidiospores mostly < 6 μm long, minimum length 4 μm, width < 6 μm.. 6
5* Basidiospores up to 7 μm long, up to 5-μm length, and 7-μm width.. 8
6(5) Basidiomata applanate, thin, pileus faintly sulcate; growing at the base and root of trees...................... *F. subtilissima.*
6* Basidiomata triquetrous, obtriquetrous to ungulate, solitary to imbricate and nodulous, pileus moderately to strongly sulcate.. 7
7(6) Basidiomata imbricate, olive brown, violet brown, dark brown, margin round, obtuse, and thick; basidiospores weakly to strongly dextrinoid, on average 5.1 × 4.8 μm.. *F. atlantica*
7* Basidiomata emerging in groups but with single pilei; pilei brown, dark brown; margin acute to obtuse; basidiospores strongly dextrinoid, on average 4.9 × 4.4 μm; widely distributed... *F. conyana*
8(5) Basidiomata applanate and thin; pileus faintly sulcate with multiple narrow bands; basidiospores ≥ 5 μm long, frequently 7 μm; pores small, ≥ 6 and ≤ 11 by millimeter, 97-μm diam... *F. elegans*
8* Basidiomata mostly triquetrous, ungulate, thick; pileus moderately to strongly sulcate with broad bands; basidiospores ≥ 5 μm long, rarely 7 μm; pores ≥ 4 and ≤ 9 by mm, 20–150-μm diam... 9
9(8) Growing on living and dead *Drimys* sp. rees in the Cloud Forest at 1000–1700 m asl, Araucaria Forest province, southern Brazil... *F. nubicola*
9* Growing outside of the Cloud Forest and on another hosts... 10
10(9) Species occurring in lowland forest, in Parana Forest and Pampean provinces, about 100 m asl, southern Brazil... *F. murrilli*
10* Species occurring in in Atlantic province, but mostly in Araucaria Forest province, 800–1000 m asl, southeastern and southern Brazil................................... *F. apiahyna* s.s.

Discussion

The four-gene phylogeny presented in this study (Fig. 1) confirms the existence of a high cryptic diversity under the name *F. apiahyna*. Previously, five lineages were recovered nested within *F. apiahyna* s.l., four of which were unnamed (PS) and one tentatively identified as *F. apiahyna* (Amalfi and Decock 2013). However, in addition, we found three more lineages within the *F. apiahyna* s.l. clade. Furthermore, *F. apiahyna* s.s., as we circumscribed here is mainly characterized by basidiomata with a strongly sulcate pileus, concentrically broad bands, thick context, minimum basidiospore length of 5 μm, rarely 7 μm, and on average 5.7 × 5.3 μm (Fig. 4), and mostly found in the Araucaria Forest province. As a result, from now on, it is possible to start sharpening the species boundaries of the *F. apiahyna* complex using an integrative approach.

Both ecological (host and geographic distribution) and molecular data contribute significantly toward species delimitation. Regarding morphological data, only the basidiospores (on average) of *F. conyana* stood out, which are the smallest among the species of the complex (Fig. 4, Table S1). Ecologically, while *F. conyana* is widely distributed and occurs on different hosts, *F. nubicola* is shown to be restricted to small Cloud Forest patches at high altitudes (Fig. 3), occurring exclusively on *Drimys* and preferably on *D. angustifolia*.

Fomitiporia apiahyna s.l. and their host relationships

Fomitiporia has wood-inhabiting species, on dead or living trees, suggesting it could be a group of heart-rot fungi (Rayner and Boddy 1986, 1988; Boddy 2001; Boddy et al. 2008). There are few studies concerning wood-decaying fungi and their hosts in the Neotropics (Gilbert and Sousa 2002; Gilbert et al. 2002; Gibertoni et al. 2007; Drechsler-Santos et al. 2010; Nogueira-Melo et al. 2017). Regarding *F. apiahyna* s.l., Gilbert et al. (2002, as *P. apiahynus*) suggested that it might be host-specialized on *Ocotea* spp. (Lauraceae). However, Gilbert et al. (2002) also pointed out that host specialization is rare in forests with high tree diversity. Woolley et al. (2008, as *P. robustus*) found *Fomitiporia* PS1 on *Dicymbe corymbosa* (Fabaceae) in *D. corymbosa* dominant forest, causing heart rot. Amalfi and Decock (2013) listed at least five different hosts (e.g., *Ocotea* sp., *Licania alba*, *Inga paraensis*) for *F. conyana* (under *F. apiahyna* sensu Amalfi and Decock). Moreover, Amalfi and Decock (2013) commented that *Fomitiporia* PS3 was found once on *Qualea rosea*. In addition, herein, we contributed to host exclusivity of *F. nubicola* on *Drimys* (mostly *D. angustifolia*), host recurrence of *F. apiahyna* s.s. on Lauraceae and Myrtaceae trees, and *F. murrilli* occurring on a non-native host (*Eucalyptus* sp.). As *F. murrilli* presents Neotropical distribution, it should also occur on native hosts. From the time *Eucalyptus* specimens were introduced to Brazil, *F. murrilli* must have begun to colonize it, since *Fomitiporia* species have been presented such ecological capability (see below).

Concerning fungal-host specialization in *Fomitiporia*, it appears to be frequent that several species exhibit host exclusivity or host recurrences (Zhou and Hyde 2001). Some *Fomitiporia* species are found exclusively growing on bamboo (Coelho et al. 2009). *Fomitiporia tabaquilio* is growing on *Polylepis* spp. (Robledo et al. 2006) whereas *F. cupressicola* is growing on *Cupressus arizonica* (Amalfi et al. 2012). Several species also are important pathogens on perennial crop, e.g., *F. mediterranea* on grapevine, citrus, and olive trees (Fischer et al. 2016; Markakis et al. 2019), and some species occupy new niches, "jumping on" to exotic hosts (Cabrera et al. 2014; Cloete et al. 2014; Morera et al. 2017). Thus, data about substrate, especially host, should be provided whenever possible, mainly because it improves the delimitation of species and helps into integrative taxonomy. Also, in diversification rate shifts analysis, it could help emphasize the main ecological parameters, including host relationships, that may have oriented speciation.

Fomitiporia nubicola and its relation with *Drimys* and Cloud Forest

Fomitiporia nubicola is currently known growing mostly on *D. angustifolia*, but also on *Drimys* sp., in Cloud Forest of southern Brazil. Cloud Forest is a very particular habitat found worldwide with notable climatic characteristics. In Brazil, its small geographic extension and dependence on rare microclimatic wrapping (Bruijnzeel et al. 2010; Oliveira et al. 2014) make it one of the most susceptible ecosystems to climate change (Williams et al. 2007; Goldsmith et al. 2013; Gotsch et al. 2014; Pompeu et al. 2014). In this case, we hypothesize that *F. nubicola* is endemic to the Cloud Forest of southern Brazil due to the environmental characteristics and host (*D. angustifolia*) species distribution.

Thomas et al. (2014) performed molecular dating on Winteraceae and estimated that *Drimys* emerged after disruption of the over-land connection between Sout America and Australia via Antarctica (52 MY), with a post-diversification around 13.4–16.1 MY. The North-Eastern clade of *Drimys*, containing *D. angustifolia*, diversified around 5.1–6.1 MY (Thomas et al. 2014). Although *D. angustifolia* is solely recognized host at specific level, the possibility that it also grows on a sympatric and closely related species, *D. brasiliensis*, cannot be excluded. Regarding this, the establishment of this host relationship may have occurred recently, at least in the last 6.1 MY. Future research using molecular clock analyses with more *Fomitiporia* and *Drimys* data should clarify the biogeography of these taxa in South America.

Conservation status

Despite continuous field surveys within the Atlantic Forest of southern Brazil in the last decades (Loguercio-Leite 1990; Drechsler-Santos et al. 2008; Loguercio-Leite et al. 2009), *F. nubicola* was only found at two locations: in Cloud Forest of the highlands of Aparados da Serra Geral, inside the São Joaquim National Park, and in Cloud Forest on the high Itajaí Valley (Fig. 3). As also observed in *F. cupressicola* (Amalfi et al. 2012), described a few years ago, the fungal distribution range is restricted even if its host has wider distribution range. In addition, its possible host specificity toward *Drimys* species further restricts its distribution. It is expected that this species also occurs on other nearby areas of Cloud Forest; however, it is worth highlighting that this habitat is sparsely distributed in high elevation areas of southern Brazil. Another species restricted to the Cloud Forest of southern Brazil is the plant *Crinodendron brasiliense* (Elaeocarpaceae) currently treated as Endangered (EN) by IUCN (Sühs 2018).

Many Cloud Forest areas in southern Brazil are currently threatened by human activities such as cattle grazing, fire, and land use, resulting in a continuous decline of this vegetation, up to areas neighboring National Parks. Furthermore, ongoing discussions suggest to reduce the size of this protected area by 20%. This will certainly raise the anthropic activities in the region and impact the floristic composition and the vegetation structure, as well as the fungi and other organisms living here.

Few studies having been performed on the Cloud Forest of southern Brazil regarding its original coverage, potential decline over years, and impact of anthropic actions on its biodiversity. It is difficult to estimate the potential habitat of *F. nubicola* and how many populations would exist still. However, it is well known that Tropical Montane Cloud Forest in general is highly susceptible and threatened by anthropic activities and climate change (Bruijnzeel et al. 2010). Moreover, data from the current status of forest coverage in Santa Catarina show that the Araucaria Forest province within the state, where most areas of Cloud Forest are found, is highly fragmented with only 21% of forest coverage and fragments of up to 50 ha, representing 82% of all fragments (Fundação SOS Mata Atlântica 2009; Vibrans et al. 2013).

On the basis of the above information and applying the (IUCN 2017) Red List criteria, we assign *F. nubicola* a provisional status of "Vulnerable" [VU C1+C2a(ii)]. We also reinforce the crucial importance of protecting the remaining Cloud Forest of southern Brazil in order to protect this and other restricted and potentially endangered species.

The *Fomitiporia* treated here have incompletely known distribution. *Fomitiporia conyana* has an ample distribution, and seems to be locally frequent (see the list of MUCL number, perhaps contact the collector). Furthermore, its habitat is currently not so much threatened. Its status would be unthreatened. The case of *F. apiahyna, F. elegans*, and *F. murrilli* is more uncertain. These species have southern Brazil distribution and are locally scarce. *Fomitiporia apiahyna*, apparently, is restricted to Araucaria Forest province and in its boundary. *Fomitiporia elegans* was collected originally on *Ocotea* in Argentina but the remainder hosts were not identified. *Fomitiporia murrilli* is only known from an alien host and another unidentified, in two anthropized areas. They should be classified as data deficient (DD).

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Authors' contribution Genivaldo Alves-Silva, Mateus Arduvino Reck, and Elisandro Ricardo Drechsler-Santos designed the experiment, and collected and conducted experiments in the field; Genivaldo Alves-Silva and Mateus Arduvino Reck conducted the molecular experiment; Genivaldo Alves-Silva, Mateus Arduvino Reck, Felipe Bittencourt, Gerardo Lucio Robledo, and Elisandro Ricardo Drechsler-Santos analyzed the data; Genivaldo Alves-Silva, Mateus Arduvino Reck, Rosa Mara Borges da Silveira, Felipe Bittencourt, Aristóteles Góes-Neto, and Elisandro Ricardo Drechsler-Santos evaluated critically the experiments and wrote the manuscript.

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Data availability The sequences generated and/or analyzed during the current study are available in the GenBank repository [https://www.ncbi.nlm.nih.gov/genbank/]. All analyzed specimens are deposited in public herbaria. The datasets analyzed are available in the TreeBase repository under ID mentioned in this study, [https://www.treebase.org/treebase-web/home.html].

Compliance with ethical standards

Conflict of interest The authors declare that they have no competing interests.

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MANUSCRITO II — Bambusicolous *Fomitiporia* revisited: multilocus phylogeny reveals a clade of host-exclusive species

Genivaldo Alves-Silva, Elisandro Ricardo Drechsler-Santos, Rosa Mara B. Silveira

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Bambusicolous *Fomitiporia* revisited: multilocus phylogeny reveals a clade of host-exclusive species

Genivaldo Alves-Silva [a], Elisandro Ricardo Drechsler-Santos [b], and Rosa Mara Borges da Silveira [a]

[a]Programa de Pós-Graduação em Botânica, Laboratório de Micologia, Departamento de Botânica, Universidade Federal do Rio Grande do Sul, Campus do Vale, CEP: 91501-970, Porto Alegre, Rio Grande do Sul, Brazil; [b]Programa de Pós-Graduação em Biologia de Fungos, Algas e Plantas, Laboratório de Micologia, Departamento de Botânica, Universidade Federal de Santa Catarina, Campus Universitário Trindade, CEP: 88040-900, Florianópolis, Santa Catarina, Brazil

ABSTRACT
Fomitiporia is a genus of wood-inhabiting Hymenochaetaceae (Agaricomycetes) that includes pathogens and decomposers occurring on a wide array of plant substrates. Some species decay culms of woody bamboos, a poorly known biotic interaction. Four bambusicolous species of *Fomitiporia* are currently known. However, no studies concerning their phylogenetic relationships have been performed. In order to assess species boundaries and their relationships to each other, we conducted molecular phylogenetic analyses of nuc rDNA internal transcribed spacer region ITS1-5.8S-ITS2 (ITS) and portions of nuc 28S rDNA (28S), RNA polymerase II second largest subunit (*RPB2*), and translation elongation factor 1-α (*TEF1*), as well as morphological analyses. Four species that occur on culms of woody bamboos, *F. bambusarum*, *F. spinescens*, *F. uncinata*, and the new species *F. bambusipileata*, grouped together in an exclusive clade within a primarily Neotropical lineage. The new species differs from all other species in the group by the pileate basidiomata. Hypotheses regarding host-exclusivity are discussed.

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INTRODUCTION

Fomitiporia is a poroid genus of Hymenochaetales described by Murrill (1907). For a long time, this genus was considered a synonym of *Phellinus*, but later it was circumscribed to include species of the *Phellinus robustus* group initially delimited by biochemical data (Fiasson and Niemelä 1984; Fischer 1996) and by DNA sequences (Wagner and Fischer 2001, 2002) combined with morphological features. *Fomitiporia* is now characterized mainly by basidiospore traits (hyaline, dextrinoid, strongly cyanophilous, globose to subglobose in shape), the presence of hymenial setae in some species, a dimitic hyphal system, and resupinate to pileate basidiomata (Decock et al. 2007; Dai 2010).

Species of *Fomitiporia* are wood-inhabiting and distributed worldwide, but in the Neotropics extensive sampling has only been carried out recently. Three new species have been described and cryptic diversity detected from mostly in northern South America (Amalfi and Decock 2013, 2014; Amalfi et al. 2014; Campos-Santana et al. 2014). In other studies, an additional four new species have been described and documented from Brazil (Li et al. 2016), central Argentina and French Guiana (Morera et al. 2017), and Chile (Rajchenberg et al. 2019). Nevertheless, our understanding of *Fomitiporia* taxonomy and diversity in Brazil remains poor.

Currently, there are four species of *Fomitiporia* that occur on woody bamboos, mainly characterized by resupinate basidiomata and the presence of hymenial setae. *Fomitiporia spinescens* features subapical spines on the setae, *F. uncinata* has uncinate setae, *F. sanctichampagnatii* has the largest pores in the group, and *F. bambusarum* differs from these by having the smallest setae (Coelho and Wright 1996; Coelho et al. 2009; Campos-Santana et al. 2015). *Fomitiporia spinescens* and *F. sanctichampagnatii* occur on unidentified bamboos, *F. bambusarum* on *Bambusa tuldoides*, *Guadua* sp., and *Merostachys multiramea*, and *F. uncinata* on *Chusquea* sp. (Rajchenberg 1987; Coelho et al. 2009). Thus, these species seem to occur only on plant species of the Bambuseae tribe (Bambusoideae, Poaceae), the so-called tropical woody bamboos (Schmidt and Longhi-Wagner 2009; Wysocki et al. 2015; Canavan et al. 2016; Soreng et al. 2017). However, none of these species have been characterized phylogenetically, and their relationships to other species of *Fomitiporia* are unknown.

CONTACT Genivaldo Alves-Silva genivaldobio@gmail.com
Supplemental data for this article can be accessed on the publisher's Web site

Here, we ask whether these four *Fomitiporia* species described growing on woody bamboos represent phylogenetically separate species. If so, do they form a monophyletic group indicative of a single evolutionary transition to woody bamboos? To address these questions, we use morphological and multilocus molecular data sets and assessed ecological data about these fungus-plant associations.

MATERIALS AND METHODS

Taxon sampling, geographic distribution, and morphological analysis.—Geographic distributions are presented from the Neotropical regionalization proposed by Morrone (2014). The maps were built with QGIS 3.0.3 "Girona" (Sherman et al. 2012) from shape files provided by Löwenberg-Neto (2014). Specimens were collected in the Chacoan and Parana domains, including Araucaria Forest geological province ("province" hereafter) in Paraná State, Atlantic province in Paraná, Rio Grande do Sul, and São Paulo states, and Pampeam and Parana Forest provinces in the Rio Grande do Sul State. All specimens have been deposited at ICN (herbarium codes follow Thiers [continuously updated]). Type specimens from BAFC, ICN, and PACA were also examined.

Basidiomata colors were described according to Kornerup and Wanscher (1978). Free-hand sections of basidiomata were examined in Melzer's reagent, cotton blue (CB) in lactic acid, neutral lactophenol, 3% KOH, and 1% phloxine plus KOH to check dextrinoidity, cyanophily, natural colors, and xanthocroic reactions (Largent et al. 1977; Ryvarden 1991; Kirk et al. 2008). All microscopic measurements (n = 40) were made in Melzer's reagent. The size of microscopic elements is given as value (or interval) followed by 5% variation in parentheses, if pertinent. The following abbreviations were used: avg = average, diam = diameter, Q = range of the length/width ratio, and Qm = mean of the length/width ratios from basidiospore measurements. Box plots of seta lengths were generated in R (R Core Team 2013).

DNA extraction, PCR amplification, and sequencing.—Dried basidiomata samples were used for the DNA extraction following Góes-Neto et al. (2005). Primer pairs ITS8F-ITS6R (Dentinger et al. 2010) and LR0R-LR7 (Vilgalys and Hester 1990; Cubeta et al. 1991) were used to amplify nuc rDNA internal transcribed spacer region ITS1-5.8S-ITS2 (ITS) and nuc rDNA 28S (28S), respectively. A fragment between exons 4 and 8 of the translation elongation factor 1-alpha (*TEF1*) (Wendland and Kothe 1997) was amplified with the primer pair 983F-2212R (Rehner and Buckley 2005). We also amplified and sequenced the most variable region of RNA polymerase II second largest subunit (*RPB2*) using primers b6F and b7.1R (Frøslev et al. 2005; Matheny 2005). Polymerase chain reaction (PCR) was performed with a total volume of 40 μL containing 20 μL of 2× PCR Taq Master Mix (Applied Biological Material, Vancouver, Canada), 0.8 μL of primer (10 pM), 1–2 μL of DNA, and q.s. sterile distilled water. All PCR products were purified with PEG 20% [poly(ethylene glycol) 8000 plus NaCl 2.5 M] and then were sequenced with a BigDye Terminator 3.1 Cycle Sequencing Kit (Applied Biosystems, Foster City, California) following the manufacturer's procedures. In addition to the primers listed above, the following were used to sequence *TEF1*: 1567R and 2212R (Rehner and Buckley 2005). Sequencing was performed at the Centro de Pesquisas René Rachou (FIOCRUZ) (Belo Horizonte, Brazil).

Molecular phylogenetic analysis.—Sequences were assembled and manually corrected in Geneious 9 (Kearse et al. 2012) then automatically aligned with MAFFT 7 (Katoh and Standley 2013) under the "auto" mode for strategy. Where necessary, alignments were manually adjusted in MEGA7 (Kumar et al. 2016). Also, in MEGA7, for protein-coding gene sequences, the assignment of codon positions was confirmed by translating nucleotide sequences into predicted amino acid sequences.

We carried out phylogenetic analyses on two data sets: (i) 4 loci combined: ITS+28S+*TEF*1+*RPB2* and (ii) 2 loci combined: ITS+28S. The 4-locus data set was subdivided into 11 data partitions: ITS1, 5.8S, ITS2, 28S, TEF1-1st, -2nd, -3rd codon positions, TEF1 introns, RPB2-1st, -2nd. and -3rd codon positions (including the first 12 positions of intron 4), and the 2-locus data set was subdivided into four data partitions: ITS1, 5.8S, ITS2, and 28S. Only ITS data were obtained for *F. spinescens*. In addition, one 28S sequence from an Argentina specimen (HE651014) is available in GenBank. Thus, we carried out maximum likelihood (ML) phylogenetic analyses of ITS and 28S separately to confirm this species and its relationships with other *Fomitiporia* species from woody bamboos (data not shown). When comparing ML bootstrap tree topologies obtained for the individual data sets, no conflict involving significantly supported nodes was found, and we combined them into 2-locus and 4-locus data sets. Alignments were deposited at TreeBASE (ID 24525).

Phylogenetic analyses were performed online at the CIPRES Science Gateway (Miller et al. 2011). We analyzed the data sets separately using maximum likelihood

(ML) and Bayesian inference (BI) approaches. ML analysis was carried out in RAxML 8.2.9 (Stamatakis 2014). The analysis first involved 100 ML searches, each starting from one randomized stepwise addition parsimonious tree under a GTRGAMMAI model, with all parameters estimated by the software. We provided a partition file to force RAxML to search for a separate evolution model for each partition. To access the reliability of nodes, we computed rapid bootstrapping replicates under the same model, allowing the program to halt bootstrapping automatically by extended majority rule (MRE)-based bootstopping criterion (Pattengale et al. 2009). Bootstrap (BS) values >70% were considered significant.

Bayesian inference was performed in MrBayes 3.2.6 (Ronquist et al. 2012). Evolutionary models for BI were estimated using the Akaike information criterion (AIC) for each partition as implemented in MrModeltest 2.3 (Nylander 2004). The best-fit models for each partition were implemented as partition-specific models within partitioned mixed-model analyses (SUPPLEMENTARY TABLE 1). We set two independent runs, each with four simultaneous chains, for 50 million generations, sampling trees every 100th generation. The convergence diagnostic was calculated every 10 000th generation, and its critical value was set to stop the analysis automatically when the standard deviation of the split frequencies reached the value defined by the stopval command (stoprule = yes, stopval = 0.01). The first 25% of trees from each run were discarded as burn-in, and the 50% majority-rule tree with branch lengths and posterior probabilities (BPPs) was calculated from the remaining trees. A BPP value above 0.95 was considered significant. We used *Phellinus uncisetus* as an outgroup based on previous studies (Amalfi et al. 2010, 2012, 2014; Amalfi and Decock 2013). All materials and sequences used in this study are listed in TABLE 1. All *Fomitiporia* sequences are available in GenBank.

RESULTS

Molecular phylogenetic analysis.—We generated 28 new sequences, 7 from each DNA region. The final DNA sequence alignments, variable parsimony-uninformative positions, and parsimony-informative positions are listed in the SUPPLEMENTARY TABLE 1.

A total of 82 specimens representing 41 (40 ingroup) species or potential species/clades were recovered from the 4-locus data set. The 4-locus data set (ITS+28S +*TEF1*+*RPB2*) resulted in a 3785-bp aligned matrix. All pertinent information about the 11 partitions is summarized in the SUPPLEMENTARY TABLE 1. Of all specimens included in this data set, the ITS from ICN 200561 was not obtained. In Bayesian analysis, after 70 000 generations, runs converged to stable likelihood values (−lnL = 23 425.53 and 23 428.97), and 1052 stationary trees were used to compute a 50% majority-rule consensus tree and to estimate BPPs of internodes. From the ML searches with RAxML, the 4-locus alignment had 1718 distinct patterns, with a proportion of gaps and undetermined characters of 7.3%. The bootstopping criteria of RAxML indicated 108 pseudoreplications as sufficient to determine internal branch support, and the final ML optimization likelihood was −lnL = 23 789.59. No topological conflict involving significantly supported nodes was found; therefore, both BS and BPP values were superimposed in the best-scoring ML tree (FIG. 1). The *F. spinescens* specimens with ITS (ICN 200566, Brazil) and 28S (TFC2010-036, Argentina) only were analyzed in the 2-locus data set, and the best-scoring ML tree is shown in FIG. 2.

The recovered ML and BI topologies were highly congruent overall, as shown by the number of clades meaningfully supported by BS and BPP in the best-scoring ML tree (FIG. 1). The relationships mentioned below are from 4-locus data set analyses and were strongly to fully supported (BS ≥ 90%, BPP ≥ 0.99). All Neotropical *Fomitiporia* species were recovered in a single clade, which also included non-Neotropical species, outside the tropics from southern regions of the USA and South America. In this clade, the earliest diverging lineage was (i) *F. texana*, sister to the remaining. Three other minor clades were recovered: (ii) *F. langloisii*–*F. castilloi* clade, which includes mostly resupinate species; (iii) *F. baccharidis* plus *F. tabaquilio*, both Andean species; and (iv) *F. apiahyna* sensu lato plus *F. subtilissima*. All *Fomitiporia* species found growing on tropical woody bamboos were nested within the *F. langloisii*–*F. castilloi* clade. Here named "bambusicolous *Fomitiporia*," this clade includes *F. bambusarum, F. spinescens, F. uncinata*, and the new species *F. bambusipileata*, which was recovered as sister to the remaining species (FIGS. 1 and 2). Concerning *F. sanctichampagnatii*, we did not obtain any molecular data.

Collections and morphological analysis.—All eight specimens collected in this study were found growing on bamboos and in the Chacoan and Parana domains of Brazil (SUPPLEMENTARY FIG. 1). The bamboo hosts were *Bambusa tuloides, Guadua* sp., and *Merostachys multiramea*, all classified within the Bambuseae tribe, the tropical woody bamboos. The bambusicolous *Fomitiporia* species were characterized mainly by having resupinate basidiomata (FIG. 3), dextrinoid basidiospores, and hymenial setae (FIG. 4;

Table 1. Summary of specimens included in molecular analyses.

			GenBank accession numbers			
Taxon	Herbarium voucher	Locality	28S	ITS	*TEF1*	*RPB2*
F. aethiopica	MUCL 44806	Ethiopia	AY618202	GU461944	GU461892	JQ087955
F. aethiopica	MUCL 44777 T	Ethiopia	AY618204	GU478341	GU461893	JQ087956
F. apiahyna	ICN 200542	Brazil	MN918564	MN918571	MN918580	MN918587
F. apiahyna	ICN 200543	Brazil	MN918565	MN918572	MN918581	MN918588
F. australiensis	MUCL 49406 PT	Australia	GU462001	AY624997	GU461897	JQ087959
F. baccharidis	MUCL 47757	Argentina	JQ087914	JQ087887	JQ087941	JQ087994
F. baccharidis	MUCL 47758	Argentina	JQ087915	JQ087888	JQ087942	JQ087995
F. bakeri	MUCL 51098	USA	JQ087901	JQ087874	JQ087928	JQ087960
F. bambusarum	ICN 200562	Brazil	**MN918536**	**MN918543**	**MN918550**	**MN918557**
F. bambusarum	ICN 200563	Brazil	**MN918537**	**MN918544**	**MN918551**	**MN918558**
F. bambusarum	ICN 200564	Brazil	**MN918538**	**MN918545**	**MN918552**	**MN918559**
F. bambusipileata, sp. nov.	ICN 200559 PT	Brazil	**MN918539**	**MN918546**	**MN918553**	**MN918560**
F. bambusipileata, sp. nov.	ICN 200560 PT	Brazil	**MN918540**	**MN918547**	**MN918554**	**MN918561**
F. bambusipileata, sp. nov.	ICN 200557 T	Brazil	**MN918541**	**MN918548**	**MN918555**	**MN918562**
F. bannaensis	MUCL 46950	China	EF429218	GU461943	GU461899	JQ087962
F. bannaensis	MUCL 45926	Thailand	EF429217	GU461942	GU461898	JQ087961
F. calkinsii	MUCL 52346	Mexico	JQ087903	JQ087876	JQ087930	JQ087964
F. calkinsii	MUCL 51100 T	USA	JQ087902	JQ087875	JQ087929	JQ087963
F. capensis	MUCL 53009	South Africa	JQ087917	JQ087890	JQ087944	JQ087997
F. castilloi	MUCL 53481 T	French Guiana	JQ087916	JQ087889	JQ087943	JQ087996
F. castilloi	MUCL 53980 PT	French Guiana	JX093830	JX093786	JX093743	JX093874
F. cupressicola	MUCL 52486 T	Mexico	JQ087904	JQ087877	JQ087931	JQ087965
F. cupressicola	MUCL 52488	Mexico	JQ087905	JQ087878	JQ087932	JQ087966
F. dryophila	MUCL 46380	USA	EF429219	EF429238	GU461900	JQ087970
F. dryophila	MUCL 46379	USA	EF429221	EF429240	GU461902	JQ087969
F. erecta	MUCL 49871	France	GU461976	GU461939	GU461903	JQ087971
F. expansa	MUCL 55026	French Guiana	KJ401032	KJ401031	KJ401033	KJ401034
F. gabonensis	MUCL 51291	Gabon	GU461986	GU461967	GU461924	JQ087973
F. gabonensis	MUCL 47576 T	Gabon	GU461990	GU461971	GU461923	JQ087972
F. hartigii	MUCL 53549	Estonia	JX093831	JX093787	JX093744	JX093875
F. hartigii	MUCL 31400	Japan	JQ087909	JQ087882	JQ087936	JQ087975
F. hippophaeicola	MUCL 31746	Belgium	AY618207	GU461945	GU461904	JQ087976
F. hippophaeicola	MUCL 31747	Belgium	GU461977	GU461946	GU461905	JQ087977
F. ivindoensis	MUCL 51312 T	Gabon	GU461978	GU461951	GU461906	JQ087979
F. ivindoensis	MUCL 51311	Gabon	GU461979	GU461952	GU461907	JQ087978
F. juniperina	MA PA02	Italy	KF444727	KF444704	KF444777	KF444750
F. juniperina	MUCL 51757	Tunisia	JQ087927	JQ087900	JQ087954	JQ088019
F. langloisii	MUCL 46165	USA	EF429223	AY340026	GU461909	JQ087981
F. langloisii	MUCL 46375	USA	EF429225	EF429242	GU461908	JQ087980
F. maxonii	MUCL 46017	Cuba	EF429230	EF433559	GU461910	JQ087983
F. maxonii	MUCL 46037	Cuba	EF429231	EF433560	GU461911	JQ087982
F. mediterranea	MUCL 38514	Italy	AY618201	GU461953	GU461912	JQ087984
F. mediterranea	AFTOL ID 688	ND	AY684157	AY854080	AY885149	AY803748
F. neotropica	MUCL 51335 T	Argentina	KF444721	KF444698	KF444771	KF444744
F. neotropica	MUCL 51336 PT	Argentina	KF444722	KF444699	KF444772	KF444745
F. neotropica	MUCL 54246	Brazil	KF444720	KF444697	KF444770	KF444743
F. neotropica	MUCL 53114	French Guiana	JX093836	JX093792	JX093749	JX093880
F. nobilissima	MUCL 51289 T	Gabon	GU461984	GU461965	GU461920	JQ087987
F. nobilissima	MUCL 47580	Gabon	GU461985	GU461966	GU461921	JQ087986
F. polymorpha	MUCL 46166 PT	USA	DQ122393	GU461955	GU461914	JQ087988
F. polymorpha	MUCL 46167 PT	USA	EF429233	GU461956	GU461915	JQ087989
F. pseudopunctata	MUCL 51325	Czech	GU461981	GU461948	GU461916	JQ087998
F. pseudopunctata	MUCL 46168	France	JQ087918	JQ087891	JQ087945	JQ087999
F. punctata	MUCL 53548	Europe	JX093834	JX093790	JX093747	JX093878
F. punctata	MUCL 34101	Germany	AY618200	GU461947	GU461917	JQ088000
F. punicata	Cui 23	China	GU461991	GU461974	GU461927	JQ088002
F. punicata	Cui 26	China	GU461992	GU461975	GU461928	JQ088003
F. robusta	MUCL 51327	Czech	GU461993	GU461949	GU461929	JQ088005
F. robusta	MUCL 51297	Estonia	JQ087919	JQ087892	JQ087946	JQ088004
F. sonorae	MUCL 47689 T	USA	JQ087920	JQ087893	JQ087947	JQ088006
F. spinescens	TFC2010-036	Argentina	HE651014	—	—	—
F. spinescens	ICN 200566	Brazil	—	**MN918549**	—	—
F. subtilissima	FURB 47557 T	Brazil	KU557527	KU557531	KU557532	KU557533
F. tabaquilio	MUCL 46230	Argentina	DQ122394	GU461940	GU461931	JQ088008
F. tabaquilio	MUCL 47754	Argentina	GU461994	GU461941	GU461932	JQ088009
F. tenuis	MUCL 44802 T	Ethiopia	AY618206	GU461957	GU461934	JQ088010
F. tenuis	MUCL 49948	Gabon	GU461998	GU461958	GU461935	JQ088011
F. texana	MUCL 47690 T	USA	JQ087921	JQ087894	JQ087948	JQ088013
F. texana	MUCL 51143	USA	JQ087922	JQ087895	JQ087949	JQ088014
F. torreyae	WC3	China	JQ087924	JQ087897	JQ087951	JQ088016
F. torreyae	MUCL 47628	Japan	JQ087923	JQ087896	JQ087950	JQ088015
F. tsugina	MUCL 51295	USA	JQ087908	JQ087881	JQ087935	JQ087974
F. tsugina	MUCL 52703	USA	JQ087926	JQ087899	JQ087953	JQ088018
F. uncinata	ICN 200561	Brazil	**MN918542**	—	**MN918556**	**MN918563**

(*Continued*)

Table 1. (Continued).

Taxon	Herbarium voucher	Locality	GenBank accession numbers			
			28S	ITS	*TEF1*	*RPB2*
Fomitiporia sp.	ICN 200553	Brazil	MN918569	MN918577	MN918585	MN918592
Fomitiporia sp.	ICN 200555	Brazil	MN918570	MN918578	MN918586	MN918593
Fomitiporia sp.	FLOR 57850	Brazil	KU663275	KU663303	KU663328	KU663352
Fomitiporia sp.	FLOR 57857	Brazil	KU663282	KU663309	KU663334	KU663359
Fomitiporia sp.	FLOR 58547	Brazil	KU663270	KU663298	KU663324	KU663348
Fomitiporia sp.	MUCL 51456	Ecuador	JX093813	JX093770	JX093726	JX093857
Fomitiporia sp.	MUCL 51474	Ecuador	JX093814	GU461961	JX093727	JX093858
Fomitiporia sp.	MUCL 53041	French Guiana	JX093816	JX093772	JX093729	JX093860
Phellinus uncisetus	MUCL 46231	Argentina	EF429235	GU461960	GU461937	JQ088020
Phellinus uncisetus	MUCL 47061	Argentina	GU462000	GU461972	GU461938	JQ088021

Note. New sequences generated in this study are marked in bold. T = type; PT = paratype.

SUPPLEMENTARY FIGS. 2 and 3). All specimens that were morphologically studied are presented in a comparative table (SUPPLEMENTARY TABLE 2). For comparisons of hymenial setae, box plot graphics were built from the following specimens: *Fomitiporia bambusarum*: ICN 200562, ICN 200563, ICN 200564, PACA 18570 (holotype), PACA 13938 (*Lopharia* holotype), and ICN 200569 with 138 measurements; *F. bambusipileata*, sp. nov.: ICN 200557 and ICN 200560 with 5 measurements; *F. sanctichampagnatii*: ICN 139044 (type), ICN 139201, ICN 139202, and ICN 139203 with 89 measurements; *F. spinescens*: ICN 97790 (type), ICN 97793, and ICN 200566 with 34 measurements; and *F. uncinata*: ICN 200561, BAFC 29836 (type; from Rajchenberg 1987) with 35 measurements.

From morphological comparisons of type specimens, such as *F. bambusarum* (PACA), *F sanctichampagnatii* (ICN), *F. spinescens* (ICN), and *F. uncinata* (BAFC), with our collections, we were able to distinguish all bamboo-occurring species. Even though *F. sanctichampagnatii* was not sampled in the molecular phylogenetic treatment, it was differentiated morphologically (see Taxonomy below).

TAXONOMY

Fomitiporia bambusipileata Alves-Silva, Drechsler-Santos & R.M.B. Silveira, sp. nov. FIGS. 1, 2, 3H, 4J–K, 5

MycoBank MB833901

Typification: BRAZIL. PARANÁ: Campo Mourão, Parque Estadual do Lago Azul, 24°06′15.2″S, 52°18′30.1″ W, on dead standing bamboos (*Merostachys* sp.), 25 Feb 2017, *G. Alves-Silva 1070* (**holotype** ICN 200557).

Etymology: *bambusipileata* (Latin), in reference to a pileate form found on bamboos.

Description: Basidiomata perennial, pileate; primordia nodulose, thick, rounded; mature basidiomata sessile to broadly attached, solitary to imbricate; semicircular, triquetrous, obtriquetrous, projecting 5–19 mm, 5–32 mm wide and 5–38 mm thick at the base, with a woody consistency. Pileus glabrous, faintly sulcate, mainly dull blackish; margin rounded, folded, thick, sterile, pale yellow to light yellow [4A(3–5)] in young specimens, golden yellow (5B7), grayish orange to golden yellow [5B(5–8)] in age. Pore surface grayish brown at first, brownish beige (6DE3) to cinnamon when older; pores rounded to angular, lacerated near the margin in youth, 6–9(–10)/mm, (60–)80–160(–190) μm diam (avg = 122 μm); dissepiments entire, 30–100(–110) μm (avg = 56 μm) thick; tubes distinctly stratified, up to 4 layers, individual layers up to 7 mm, with interleaved thin context in older basidiomata, light brown [6D(5–6)], youngest (active) layer grayish brown (6E4) to cinnamon, older layers filled with whitish mycelium; context simple, slightly zonate, up to 1 mm thick with dense texture and woody consistency, golden brown to yellowish brown [5DE(7–8)], with a thin black line near the surface.

Hyphal system dimitic in all parts; generative hyphae simple-septate, hyaline to pale yellow, sparingly branched, 2–2.5 μm diam; skeletal hyphae golden brown to reddish brown, unbranched, thick-walled, occasionally with local swellings up to 6 μm diam, (2–)2.5–3.5 μm diam, the lumen 1–2(–2.5) μm wide in the context, (2.5–)3–4 μm diam, the lumen 1–2(–2.5) μm wide, 255–450 μm long in the hymenophoral trama. Hymenial setae rarely present, mostly in old layers, scattered, slightly ventricose, straight, occasionally with a slightly uncinate apex, infrequently with a small hyphal-like base, 21–30 × 4.5–5(–9.5) μm (avg = 25 × 6 μm). Cystidioles rare, fusoid, lanceolate, hyaline, thin-walled. Basidia subglobose to globose, barrel-shaped, pyriform, hyaline, tetrasporic, 9–10(–11) × 7–8(–9.5) μm (avg = 10.3 × 7.4 μm), Q = 1.3–1.4 μm (Qm = 1.4 μm); basidioles identical in shape but slightly smaller than basidia. Basidiospores subglobose to globose, 4–6(–6.5) × 4–5(–5.5) μm (avg = 5.2 × 4.5 μm), Q = 1.2–1.4(–1.5) μm (Qm = 1.15 μm), hyaline, slightly to moderately dextrinoid and cyanophilous, thick-walled, smooth.

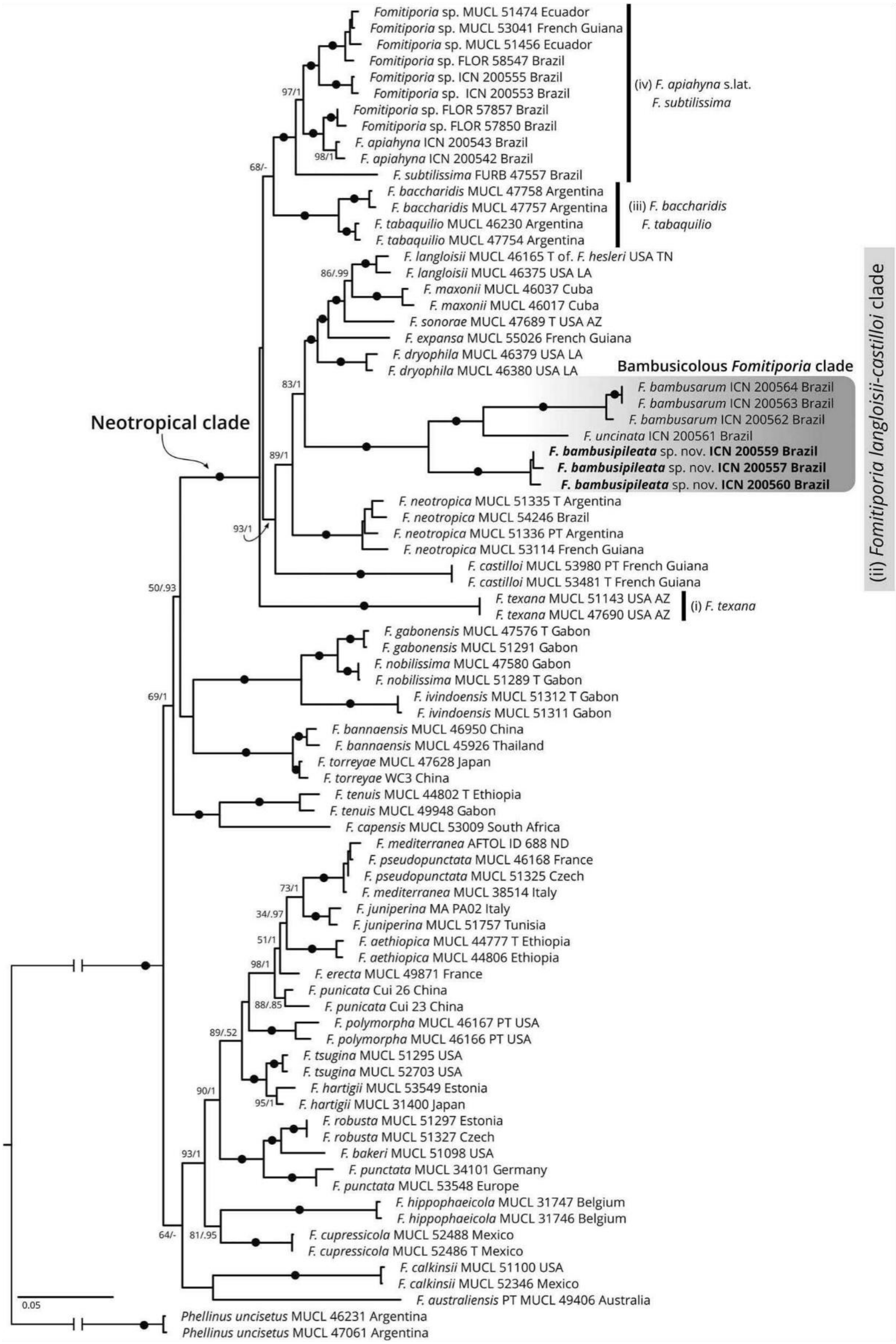

Figure 1. Phylogenetic tree of *Fomitiporia* based on ML analysis of combined ITS, 28S, *TEF1*, and *RPB2* sequences. Black filled circles represent BS/BPP = 99%/0.99 or higher. Numbered clades are mentioned in the text. The shaded clade indicates the cluster of bamboo-occurring *Fomitiporia*. Bold font is used to indicate the newly described *F. bambusipileata*.

Figure 2. Phylogenetic tree of *Fomitiporia* based on ML analysis of combined ITS and 28S sequences. Black filled circles represent BS/BPP = 99%/0.99 or higher. The shaded clade indicates the cluster of bamboo-occurring *Fomitiporia*. Bold font is used to indicate the newly described *F. bambusipileata*.

Ecology and distribution: On dead culms of bamboos (*Merostachys* sp. and *M. multiramea*). Currently known from Brazil in Araucaria Forest and Parana Forest provinces, Paraná and Rio Grande do Sul states, respectively (SUPPLEMENTARY FIG. 1C).

Comments: Fomitiporia bambusipileata is characterized mainly by having pileate basidiomata, rare and straight hymenial setae, 21–30 × 4.5–5(–9.5) μm in range, and basidiospores slightly to moderately dextrinoid (SUPPLEMENTARY FIG. 2) with an average size of 5.2 × 4.5 μm. This species differs from others on bamboos by the presence of a pileus (FIGS. 3 and 5). *Fomitiporia bambusipileata* differs from similar species with pileate basidiomata and hymenial setae, such as *F. castilloi* and *F. texana*, mainly by the bamboos substrate and average smaller basidiospore size.

Additional specimens examined: BRAZIL. RIO GRANDE DO SUL: Derrubadas, Parque Estadual do Turvo, 27°14′15.1″S, 53°58′38.3″W, on dead standing culm of bamboos (*Merostachys multiramea*), 29

Figure 3. Macroscopic features of bambusicolous *Fomitiporia* species. A–C. *Fomitiporia bambusarum*. A. PACA 18570 (type of *Poria bambusarum*). B. ICN 200563. C. PACA 13938 (type of *Lopharia bambusae*). D–E, J. *F. sanctichampagnatii*. D. ICN 139202 (paratype). E. ICN 139201 (paratype). J. ICN 139044 (type). F–G. *F. spinescens*. F. ICN 97790 (type). G. ICN 200566. H. *F. uncinata*, ICN 200561. I. *F. bambusipileata*, ICN 200557 (type). Bars = 3 mm.

Oct 2017, *G. Alves-Silva 1217* (ICN 200558); ibid., on dead standing culm of bamboos (Merostachys multiramea), 29 Oct 2017, *G. Alves-Silva 1219* (ICN 200559); ibid., on dead fallen culm of bamboos (*Merostachys multiramea*), 29 Oct 2017, *G. Alves-Silva 1221* (ICN 200560).

Fomitiporia bambusarum (Rick) Camp.-Sant. & Decock, in Campos-Santana, Robledo, Decock & Silveira, Cryptog Mycol 36:48. 2015. FIGS. 1, 2, 3A–C, 4A–B, I

≡ *Poria bambusarum* Rick, Brotéria NS 6:146. 1937.

= *Lopharia bambusae* Rick, Iheringia Sér Bot 7:199. 1960.

≡ *Phellinus rickianus* J.E. Wright & J.R. Deschamps, Mycotaxon 21:414. 1984.

≡ *Phellinus bambusarum* (Rick) M.J. Larsen, Synopsis Fungorum 3:40. 1990.

Basidiomata seasonal to biseasonal, resupinate, following the substrate, adnate to easily detachable, extending up to 80 mm long, 30 mm wide, 1.5 mm in the thickest part, hard corky; margin up to 0.5 mm wide, narrow, sterile, yellowish brown (5DE5), golden brown (5D7) to brown [5EF(7–8)] in age. Pore surface yellowish brown (5D5) at first, golden brown (5D7), light brown (5D8) to brown [5E5-8)] (in older one dark brown, 6F8); pores small, round to ellipsoid at inclined parts, (6–)7–9/mm, (145–)160–258(–270) μm diam (avg = 203 μm); dissepiments entire, thin to thick, (50–)58–171(–222) μm diam (avg = 92 μm). Subiculum up to 0.35 mm thick, fibrous, brown [5E (6–7)], homogeneous. Tubes uni- or bilayered, indistinct stratified, concolorous with the pore surface.

Hyphal system dimitic, identical in the context of hymenophoral trama; generative hyphae hyaline to faintly yellow, thin-walled, sparsely branched, 1.5–2 μm wide; skeletal hyphae pale yellowish brown to golden brown, thick-walled, (1.5–)2–3(–4) μm wide, lumen 0.5–1(–1.3) μm wide. Hymenial setae present, slightly ventricose to ventricose, straight, rarely apex corniform, occasionally with a small hyphal-like base, frequent in the second layer, (11–)13.5–21(–22) × 5–8.5 (–9.5) μm (avg = 17.2 × 6.9 μm). Cystidioles rare, fusoid, lanceolate, hyaline, thin-walled. Basidia subglobose to globose, hyaline, tetrasporic, (7.5–)8.5–9.5 × 7–7.5 μm (avg = 8.6 × 7.3 μm), Q = 1.2–1.3 μm (Qm = 1.2 μm); basidioles identical in shape but slightly smaller than basidia. Basidiospores subglobose to

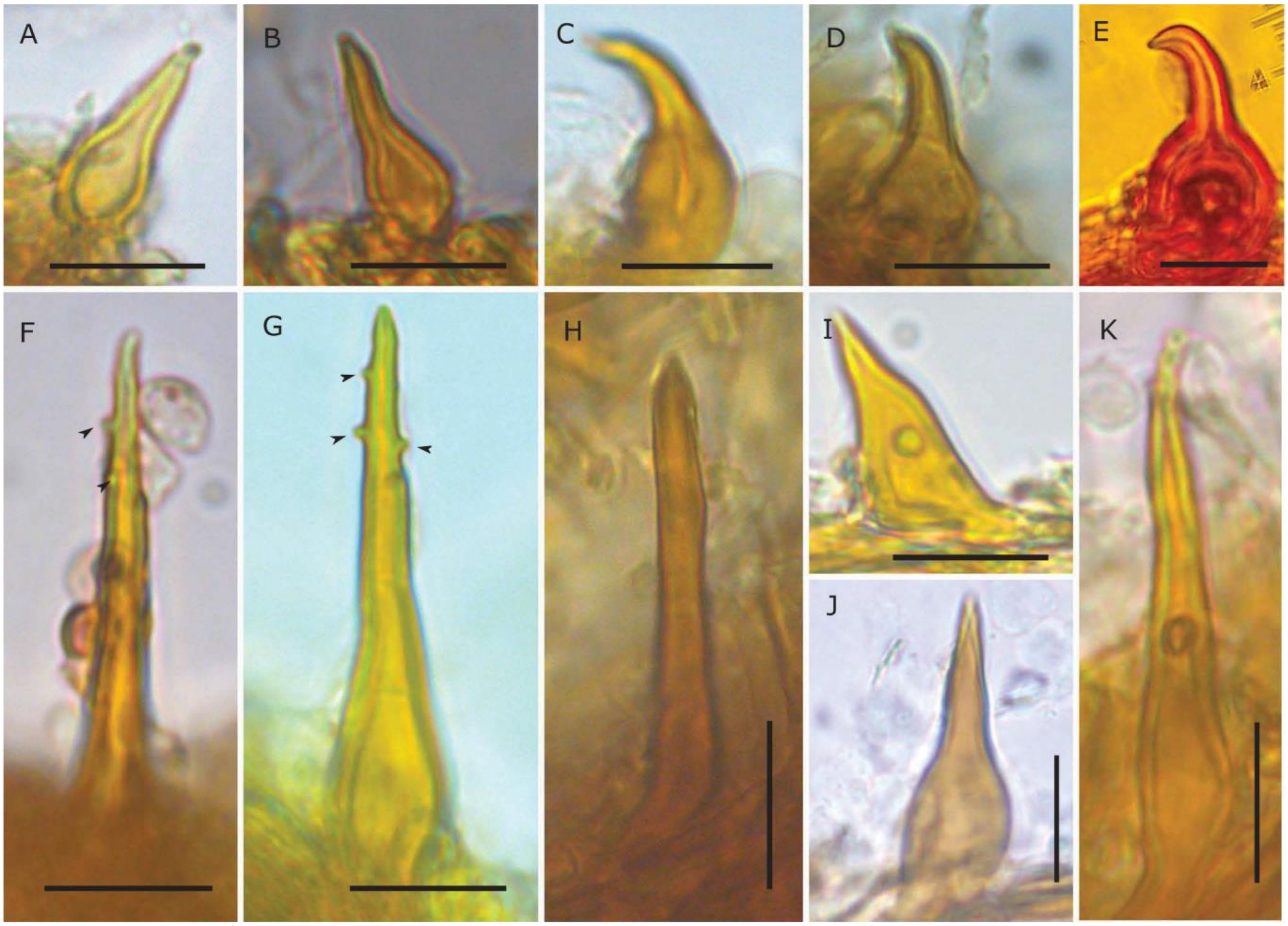

Figure 4. Microscopic features. Setae of bambusicolous *Fomitiporia* species. A–B, I. *Fomitiporia bambusarum*. A. PACA 18570 (type of *Poria bambusarum*). B. PACA 13938 (type of *Lopharia bambusae*). I. ICN 200563. C–E. *F. uncinata*. C–D. ICN 200561. E. BAFC 29836 (type). F–G. *F. spinescens*. F. ICN 97790 (type). G. ICN 200566. H. *F. sanctichampagnatii*, ICN 139202 (paratype). J–K. *F. bambusipileata*, ICN 200557 (type). Arrows indicate spines in the setae. Bars = 10 μm.

broadly obovoid, 4–5(–5.7) × 4–5 μm (avg = 4.9 × 4.6 μm), Q = 1–1.1(–1.25) (Qm = 1.1), hyaline, slightly dextrinoid and cyanophilous, thick-walled, smooth.

Ecology and distribution: On dead culms of bamboos (e.g., *Merostachys multiramea, Bambusa* sp., *Guadua* sp.). Mostly occurring in southern Brazil, in Parana Forest, Araucaria Forest, and Pampean provinces, extending to Madeira and Atlantic provinces (SUPPLEMENTARY FIG. 1A).

Specimens examined: BRAZIL. ACRE: Rio Branco, km 25 from Rio Branco to Porto Acre, on dead bamboos, 27 Sep 1980, *B. Lowy B277BR* (INPA 100134); BRAZIL. PARANÁ: General Carneiro, on dead bamboos, 27 Jun 1989, *A. Muger* (FLOR 11434); BRAZIL. PARANÁ: Piraquara, Parque Estadual Pico do Morumbi, on dead *Guadua* culm, 6 Feb 1993, *A. de Meijer 2448* (ICN 139046); BRAZIL. PARANÁ: Piraquara, Morro do Canal, on dead bamboos, 12 Nov 2010, *M. Campos-Santana 378* (ICN 178933); ibid., *M. Campos-Santana 394* (ICN 178940); ibid., *M. Campos-Santana 395* (ICN 178941); ibid., 4 Sep 2013, *M.A. Reck 748* (ICN 200569); BRAZIL. RIO GRANDE DO SUL: Derrubadas, Parque Estadual do Turvo, 27°12′04″S, 53°50′42.6″W, on dead bamboos (*Merostachys multiramea*), 29 Oct 2017, *G. Alves-Silva 1213* (ICN 200562); ibid., 27°12′04″S, 53°50′42.6″W, on dead bamboos (*M. multiramea*), 30 Oct 2017, *G. Alves-Silva 1227* (ICN 200563); BRAZIL. RIO GRANDE DO SUL: Dom Pedro de Alcântara, Reserva Particular do Patrimônio Natural Prof Luis Batista, 29°22′10″S, 49°50′59″W, on dead bamboos, 12 Mar 2010, *M. Campos-Santana 2* (ICN 178783); ibid., *M. Campos-Santana 14* (ICN 178789); ibid., on dead bamboos, 13 Aug 2011, *M. Campos-Santana 630* (ICN 179059); ibid., on dead bamboos, 13 Aug 2011, *M. Campos-Santana 633* (ICN 179062); ibid., *M. Campos-Santana 637* (ICN 179065); ibid., on dead *M. multiramea* culm, 20 May 2005, *G. Coelho* (ICN 139048); BRAZIL. RIO GRANDE DO SUL: Morrinhos do Sul, Lageadinho, 29°21′54″S, 49°56′05″W, on dead bamboos, 13 Mar 2010, *M. Campos-Santana 26* (ICN 178797); ibid., *M. Campos-Santana 28*

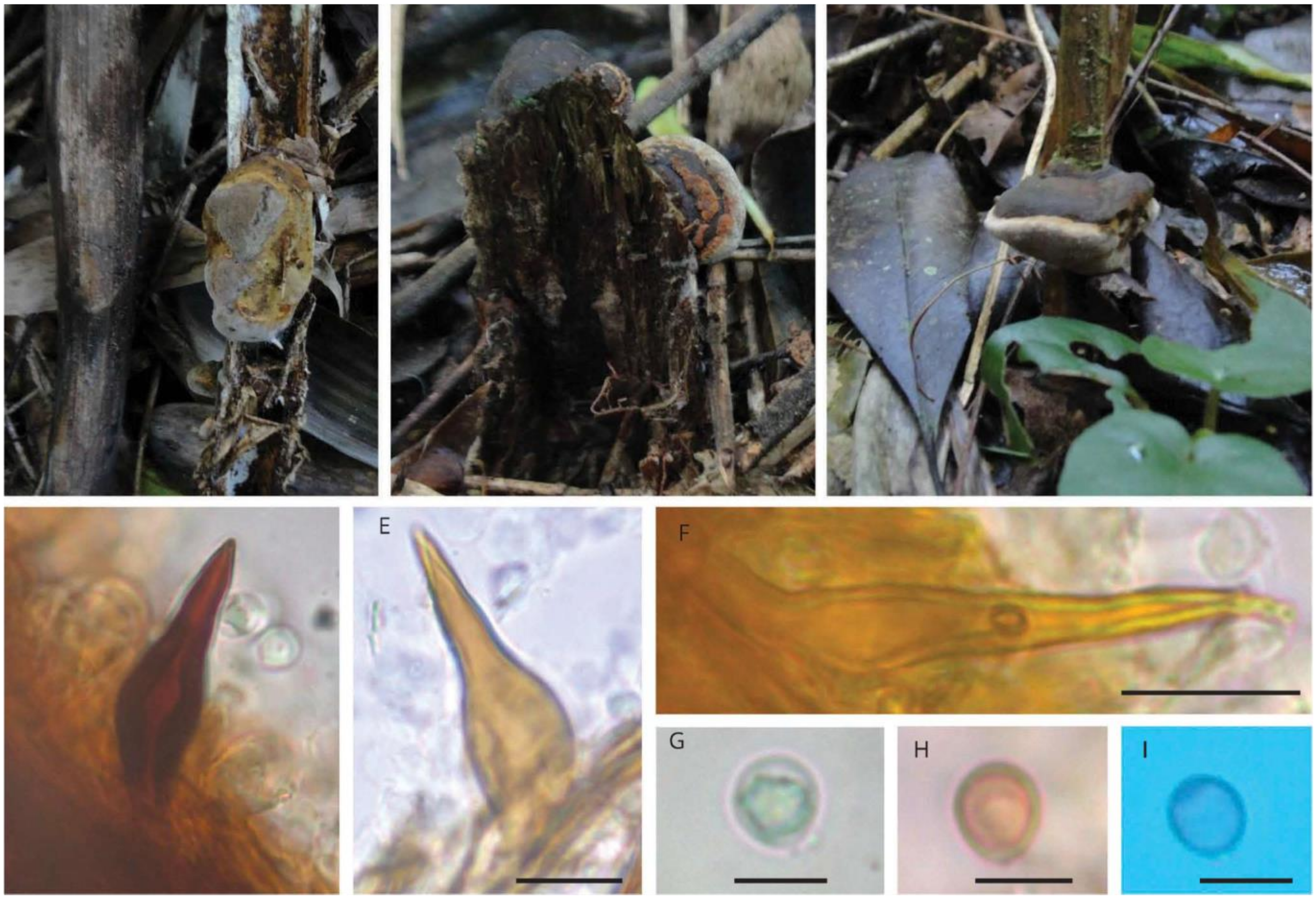

Figure 5. Morphological features of *Fomitiporia bambusipileata*. A–C. Basidiomata in situ. D–I. Micromorphological characteristics. D. Seta in 3% KOH. E–F. Setae in Melzer's reagent. G. Basidiospores in 3% KOH. H. Basidiospores in Melzer's reagent. I. Basidiospores in cotton blue. Bars A–C = 3 cm, D–F = 10 μm and G–I = 5 μm.

(ICN 178798); ibid., *M. Campos-Santana 29* (ICN 178799); BRAZIL. RIO GRANDE DO SUL: Salvador do Sul, S. Salvador, on dead bamboos, 1939, *Rick 6438* (**type** of *Lopharia bambusae*: PACA 13938); BRAZIL. RIO GRANDE DO SUL: Santa Maria, FEPAGRO, on dead *Bambusa tuldoides* culm, 26 Mar 2003, *G. Coelho 382-7* (ICN 139047); BRAZIL. RIO GRANDE DO SUL: São Francisco de Paula, Pró-Mata, Trilha Três Forquilhas, on dead *M. multiramea* culm, 11 Jun 2005, *G. Coelho* (ICN 139050); ibid., on dead *M. multiramea* culm, 10 Jun 2005, *G. Coelho* (ICN 139049); BRAZIL. RIO GRANDE DO SUL: São Francisco de Paula, Pró-Mata, on dead bamboos, 29 May 2009, *M.C. Westphalen 217* (ICN 154306); ibid., on dead bamboos, 26 Sep 2009, *M.C. Westphalen 264* (ICN 154372); ibid., Floresta Nacional de São Francisco de Paula, on dead bamboos, 24 Apr 2009, *M.C. Westphalen 179* (ICN 154305); BRAZIL. RIO GRANDE DO SUL: São Leopoldo, on dead bamboos, 1932, *Rick 8683* (**holotype** PACA 18570); BRAZIL. RIO GRANDE DO SUL: Sarandi, Parque Estadual Papagaio Charão, 27°54′41.5″S, 52°49′ 11.1″W, on dead bamboos, 31 Oct 2017, *G. Alves-Silva 1232* (ICN 200564); BRAZIL. SANTA CATARINA: Águas Mornas, Parque Estadual Serra do Tabuleiro, on dead bamboos, 17 Jan 2005, *Michels 240* (FLOR 31665); ibid., *Michels* (FLOR 31663); ibid., on dead bamboos, 18 Jan 2005, *Michels 288* (FLOR 31851); ibid., *Michels 415* (FLOR 31759); BRAZIL. SANTA CATARINA: Florianópolis, Morro da Lagoa, on dead bamboos, 26 Jul 1995, *Gerber 735* (FLOR 11263); BRAZIL. SÃO PAULO: São Luiz do Paraitinga, Parque Estadual Serra do Mar, Núcleo Santa Virgínia, 23°26′15″S, 45°14′23″W, on dead bamboos, 11 Jun 2013, *R.M. Pires 50* (SP 446263).

Comments: Fomitiporia bambusarum is described in detail here, but another description can be found in Larsen and Cobb-Poulle (1990; as *Phellinus bambusarum*). In this study, we recognized *Lopharia bambusae* (Rick 1960) as a synonym of *F. bambusarum*. Both are characterized by resupinate basidiomata (FIG. 3A, C) with straight and slightly ventricose to ventricose hymenial setae (17.2 × 6.9 μm on average) (FIG. 4) and subglobose to globose, dextrinoid basidiospores (4.9 × 4.6 μm on average). Concerning *Phellinus rickianus*, this name is superfluous as explained in Coelho et al. (2009). We did not revise the type specimen of *Phellinus garuhapensis* cited as a *F. bambusarum* synonym (Coelho et al. 2009); therefore, we did not list it as a synonym.

Through comparisons with specimens from herbaria SP and INPA, we found that *F. bambusarum* also occurs in northern and southeastern Brazil (Madeira and Atlantic provinces) (SUPPLEMENTARY FIG. 1). It is likely that this species is widely distributed in South America wherever suitable hosts (Bambuseae species) occur.

Fomitiporia spinescens (J.E. Wright & G. Coelho) G. Coelho, Guerrero & Rajchenb., in Coelho, Silveira, Guerrero & Rajchenberg, Fungal Divers 36:6. 2009. FIGS. 2, 3E–F, 4F–G

≡ *Phellinus spinescens* J.E. Wright & G. Coelho, Mycotaxon 59:384. 1996.

Description: See Coelho and Wright (1996).

Ecology and distribution: On dead culms of bamboos. In Parana Forest province (Rio Grande do Sul State) and Atlantic province (Paraná and São Paulo states) (SUPPLEMENTARY FIG. 1B).

Specimens examined: BRAZIL. PARANÁ: Piraquara, Morro do Canal, on dead bamboos, 4 Sep 2013, *M.A. Reck 745* (ICN 200565); BRAZIL. RIO GRANDE DO SUL: Santa Maria, Itaara, P. Pinhal, on dead bamboos, 23 Dec 1991, *G. Coelho* (ICN 102285); ibid., on dead bamboos, 9 Sep 1992, *G. Coelho* (FLOR 11433); ibid., on dead bamboos, 9 Sep 1992, *G. Coelho* (FLOR 11433); ibid., *G. Coelho* (**holotype** ICN 97790); ibid., on dead bamboos, 5 Oct 1992, *G. Coelho* (ICN 97791); ibid., *G. Coelho* (ICN 102208); ibid., *G. Coelho* (ICN 97793); ibid., *G. Coelho* (ICN 97793); ibid., on dead bamboos, 9 Apr 1993, *G. Coelho* (ICN 97795); ibid., on dead bamboos, 6 Apr 1993, *G. Coelho* (ICN 97794); ibid., on dead bamboos, 3 Jun 1993, *G. Coelho* (ICN 97796); ibid., on dead bamboos, 3 Oct 1993, *G. Coelho* (ICN 97798); ibid., on dead bamboos, *G. Coelho* (ICN 97797); BRAZIL. SÃO PAULO: Caraguatatuba, Parque Estadual Serra do Mar, on dead bamboos, 19 Jan 2016, *M.A. Reck 1193* (ICN 200566).

Comments: Fomitiporia spinescens is characterized mainly by having long and slightly ventricose setae with scattered spines in the subapex, a unique feature that separates it from other *Fomitiporia* that occur on bamboos (FIG. 4E–F). This species was recovered with bambusicolous *Fomitiporia* species in the 2-locus phylogeny, in which ICN 200566 was assigned to this species (FIG. 2). Although ICN 200566 has slightly smaller basidiospores [(4–)4.5–5.8(–6) × 4–5(–5.4) µm and 5.1 × 4.7 µm on average vs. 5–7(–8) × (4–)4.5–6.5 (–8) µm in range and 6.0 × 5.5 µm on average, from types], it has setae with spines, longer [(28–)30–54(–60) µm] than ICN 97790 (holotype) and ICN 97793 (paratype) [(18–)20–48(–52) µm].

Fomitiporia spinescens was initially "described" by Larsen and Cobb-Poulle (1990) as addendum from Iguazú National Park (Misiones, Argentina) specimen. However, the species was never published, and the potential type was lost (Coelho and Wright 1996). Coelho and Wright (1996) later formally described *F. spinescens* from southern Brazilian specimens.

Fomitiporia sanctichampagnatii G. Coelho, R.M. Silveira & Rajchenb., in Coelho, Silveira, Guerrero & Rajchenberg, Fungal Divers 36:6. 2009. FIGS. 3D, 4H

Description: See Coelho et al. (2009).

Ecology and distribution: On dead culms of bamboos. In Atlantic province, Rio Grande do Sul State (SUPPLEMENTARY FIG. 1D).

Specimens examined: BRAZIL. RIO GRANDE DO SUL: São Francisco de Paula, Pró-Mata, Três forquilhas trail, on dead bamboos, 10 Jun 2005, *G. Coelho* (**holotype** ICN 139044); ibid., 1 Jun 2006, *G. Coelho 492-1* (ICN 139201); ibid., *G. Coelho 492-2* (ICN 139202); ibid., *G. Coelho 492-3* (ICN 139203).

Comments: Fomitiporia sanctichampagnatii is characterized by having straight to ventricose hymenial setae (on average 25.9 × 6.4 µm). Seta length can measure up to 39 µm (SUPPLEMENTARY FIG. 3). Coelho et al. (2009) described the pores as (2–)3–4(–5)/mm; however, we found pores numbering 8–10(–11)/mm in ICN 139044 (holotype) and (3–)4–7/mm in ICN 139201 (paratype) (SUPPLEMENTARY TABLE 2). These different values could be due to recurrent projection of basidiomata on vertical substrates, causing inclined to lacerate tubes. Moreover, each specimen could have been collected at different ontogenetic stages. Such characteristics of resupinate species can hamper the measurement of pores; therefore, it must be used carefully in species comparisons and delimitations.

The species is differentiated from all other bambusicolous *Fomitiporia* by a combination of morphological characters. Even so, it should be carefully considered, because this species presents many morphological similarities to other species in the group. In this study, we were unable to obtain fresh collections of *F. sanctichampagnatii* (even from the type locality), and DNA extraction from the types was not successful.

Fomitiporia uncinata (Rajchenb.) G. Coelho, Guerrero & Rajchenb., in Coelho, Silveira, Guerrero & Rajchenberg, Fungal Divers 36:6. 2009. FIGS. 1, 2 G, 3C–E

≡ *Phellinus uncinatus* Rajchenb. Mycotaxon 28:114. 1987.

Description: See Rajchenberg (1987). 1

Ecology and distribution: On dead culms of bamboos. In Atlantic province, Rio Grande do Sul State (SUPPLEMENTARY FIG. 1E).

Specimens examined: ARGENTINA. MISIONES: Parque Nacional Iguazú, on dead bamboos, 6 Apr 1984, *Job & Rajchenberg M-3608* (**holotype** BAFC 29836). BRAZIL. RIO GRANDE DO SUL: São Francisco de Paula, Pró-Mata, on dead culms of *Merostachys multiramea*, 18 May 2016, *G. Alves-Silva 808* (ICN 200561).

Comments: Fomitiporia uncinata is characterized mainly by having ventricose uncinate setae, which differ from all other *Fomitiporia* found on bamboos (FIG. 4C–E). The specimen we collected in this study and used for phylogenetic analyses (ICN 200561) has a seta dimension range of (14–)15–22(–25) × 6–9(–10) μm, whereas in the original description (Rajchenberg 1987) of *F. uncinata* the seta dimension range is 25–35 × 6–12(–16) μm. In addition, ICN 200561 basidiospores measure 5–5.5(–6) × 4.4–5 (–6) μm, whereas *F. uncinata* bsidiospores were described as measuring 5.5–7 × 5–6.5 μm (Rajchenberg 1987). Even though the type specimen has slightly larger basidiospores and setae than ICN 200561, the shared uncinate setae (FIG. 4C–E) support ICN 200561 as this species, since uncinate setae are a unique character state in bambusicolous *Fomitiporia*. However, in order to better understand this species, collections from the type locality should be included in future analyses.

DISCUSSION

In this study, we assess bambusicolous species of *Fomitiporia* using molecular phylogeny for the first time. They were recovered as related and grouped in a Neotropical clade of the genus within a lineage of resupinate species (FIGS. 1–3). Most bambusicolous *Fomitiporia* species have resupinate basidiomata and differ from each other mainly by size and shape of setae (Coelho et al. 2009). In addition, we propose *F. bambusipileata* as a new species, which is unique because it features pileate basidiomata.

All species analyzed in this study were described based on collections from southern South America in Rio Grande do Sul State, Brazil (Rick 1937, 1960; Coelho and Wright 1996; Coelho et al. 2009), and Iguazú National Park, Argentina (Rajchenberg 1987). They have yet to be recorded elsewhere. Nevertheless, through the revision of herbarium specimens and our field collections, we found that some species also occur in northern Brazil, such as *F. bambusarum* in Madeira province (Acre State). This disjunct geographic distribution can be best explained by a lack of sampling, since this species likely follows the host distribution and could be widely distributed in the Neotropics (Clark 1990) or occur on other woody bamboos. *Fomitiporia bambusarum* appears to be a generalist, having been recorded on a variety of bamboos, such as *Guadua* sp., *Merostachys multiramea*, and *Bambusa tuldoides*, an exotic species (Schmidt and Longhi-Wagner 2009). In contrast, other *Fomitiporia* species, such as *F. bambusipileata* and *F. uncinata* on *M. multiramea*, were also found on those same bamboo species.

Of the bambusicolous hosts, only *Bambusa tuldoides* is not native to South America, having been introduced from Asia. In spite of numerous studies on bambusicolous fungi in China and Japan, *Fomitiporia* species have not been reported on bamboo substrate (Hyde et al. 2002; Tanaka and Harada 2004; Dai et al. 2017). From the time *B. tuldoides* was introduced to Brazil, *F. bambusarum* must have begun to colonize it, since it is generally able to naturally colonize woody bamboos in the Neotropics. This ecological habit has already been noticed in this genus, in which *F. impercepta* and *F. maxonii* expanded their host ranges to exotic ones (Cabrera et al. 2014; Morera et al. 2017).

Similar to our findings, the most recent studies of *Fomitiporia* worldwide recovered the Neotropical species in a unique clade, even with species extending to north (southern USA) and south (southern South America) extremes, possibly due to dispersion (e.g., Amalfi and Decock 2013; Chen and Cui 2017). The restriction of the bambusicolous lineage to woody bamboos in the Neotropics could be, at least partially, due to possible tropically distributed common ancestor of *Fomitiporia* bambusicolous species hypothesis. This may explain why they are not expected to be found elsewhere.

Out of more than 1400 bambusicolous fungi, Ascomycota are the most diverse worldwide, with Basidiomycota accounting for 15% (Hyde et al. 2002; Dai et al. 2017, 2018). Bamboo fungi are usually found on leaves as endophytes, pathogens, or saprotrophs (Hyde et al. 2002). In Hymenochaetales and Polyporales, ca. 60 species have been reported on bamboo culms (e.g., Coelho et al. 2006, 2009; Choeyklin et al. 2009; Cui et al. 2011; Nie et al. 2017). Overall, it appears that fungal species on bamboo culms are wood-rotting with no evident specificity (Zhou and Hyde 2001; Hyde et al. 2002). Within Hymenochaetales, *Coltricia bambusicola, Phellinus bambusinus*, and *P. bambusicola* were recorded growing on bamboo, but no specificity was reported (Ryvarden and Johansen 1980; Larsen and Cobb-Poulle 1990; Zhou and Jia 2010). In addition, six *Hymenochaete* species were found on bamboos, and among them only *H. bambusicola* and *H. muroiana* are exclusive to their host (Nie et al. 2017).

Zhou and Hyde (2001) suggested the use of the term "host-exclusivity" as opposed to "host-specificity" in the context of ecological studies of saprotrophic fungi. Host-exclusivity refers to the exclusive occurrence on a host or on a range of related taxa, such as tropical woody bamboos. The relationships between woody bamboos and fungi have been reported for a long time (Hyde et al. 2002). Although isolated species occupy this niche (e.g., *H. bambusicola* and *H. muroiana*), there are entire genera that do so as well, such as *Bambusicola* (Bambusicolaceae, Ascomycota) and other genera of Tetraplosphaeriaceae (Ascomycota). In these entire genera, species were described from bamboos culms (Tanaka et al. 2009; Dai et al. 2012) and later the host-exclusivity was reinforced (Dai et al. 2015, 2017).

The exclusive bambusicolous species of *Fomitiporia* revisited in this study with molecular phylogeny were retrieved as an independent clade, reinforcing the suggestion made by Tanaka et al. (2009) regarding the evolution of fungal clades on bamboo. These species exhibit host-exclusivity to Bambuseae and are geographically restricted, in this case to South America. Nevertheless, their life cycles and other putative lifestyles are not completely understood. The intrinsic and extrinsic reasons for these close relationships remain unknown for all other bambusicolous fungi as well.

Our results uncovered an intriguing lineage and contribute to new issues of ecological relationships in this fungi group. The emergence of the *Fomitiporia* lineage has potential to aid in better understanding ecological roles and other possible ecological statuses, such as neutral endophytism (Selosse et al. 2018; Wrzosek et al. 2017). In future studies, the endophytism hypothesis could be evaluated; thus, the "waiting room" scenario arises promisingly, even though the species could be nonmycorrhizal endophytes, for which this term is commonly applied. Also, in order to answer whether these bambusicolous species occur on nonbamboo hosts, long-term monitoring efforts of target hosts and adjacent plants could be performed in order to cover other putative hosts and the fungal host-jumping pathway (Promputtha et al. 2007; Oses et al. 2008; Parfitt et al. 2010; Song et al. 2017; Selosse and Martos 2014; Selosse et al. 2018). The population dynamics of bambusicolous fungi in response to cyclic and synchronized flowering and death of woody bamboos should also be monitored over the long term (Schmidt and Longhi-Wagner 2009; BPG 2012). These ecological data could provide crucial information for conservation purposes in the face of climatic change. Furthermore, sampling efforts for new collections and resampling should be performed in locations with woody bamboos, as this substrate appears to be neglected in the Neotropics.

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ORCID

Genivaldo Alves-Silva http://orcid.org/0000-0002-8142-6665
Elisandro Ricardo Drechsler-Santos http://orcid.org/0000-0002-3702-8715
Rosa Mara Borges da Silveira http://orcid.org/0000-0003-1578-5034

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Supplementary data

LEGENDS

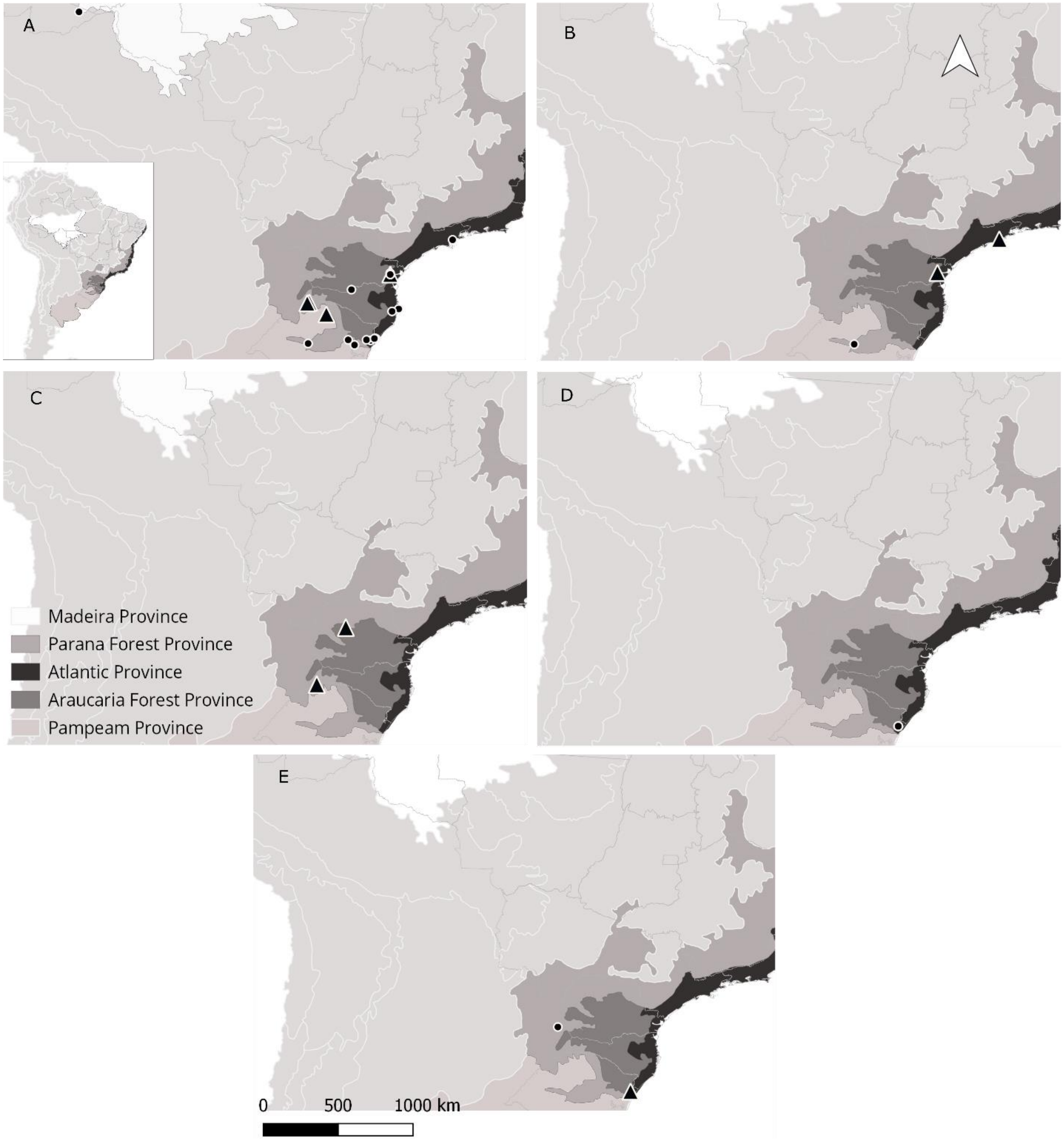
Supplementary Figure 1. Distribution map of bambusicolous *Fomitiporia* species. A. *F. bambusarum*; B. *F. spinescens*; C. *F. bambusipileata*; D. *F. sanctichampagnatii*; E. *F. uncinata*. Black circles were from herbaria collections (including types) and black triangles were from collections of these study.

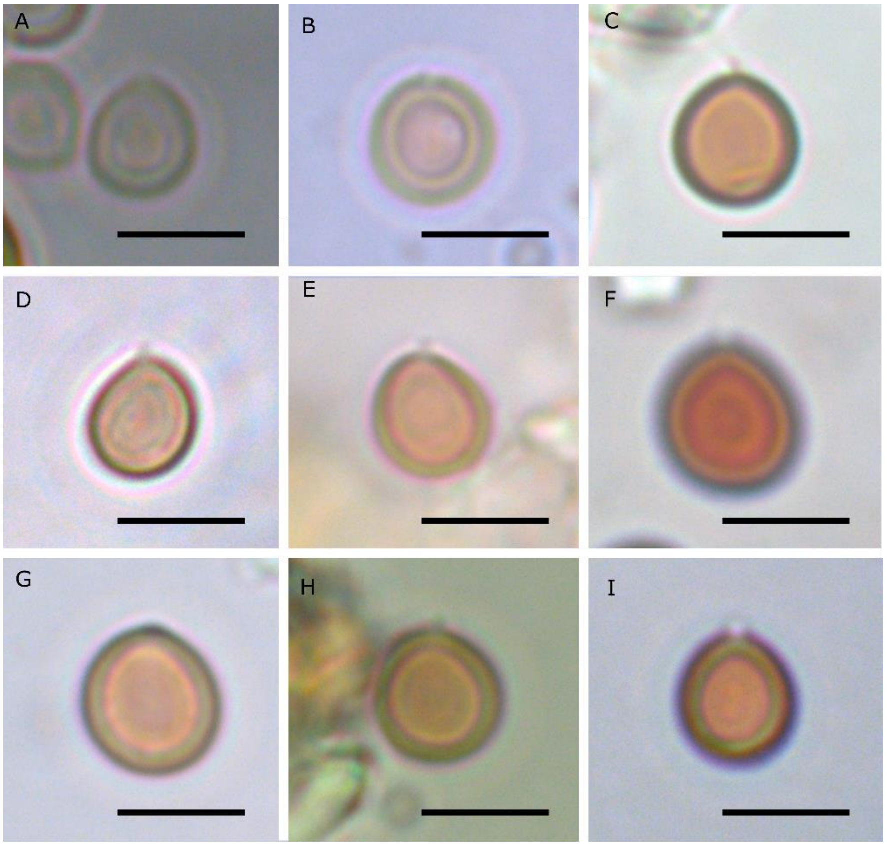
Supplementary Figure 2. Microscopic features. Dextrinoidity of basidiospores. *Fomitiporia bambusarum* (A–C) A. PACA13938, type of *Lopharia bambusae*, B. PACA18570, type of *Poria bambusarum*, C. ICN200563; *F. bambusipileata* (D–E) D. ICN200557, holotype, E. ICN200560; *F. neotropica* F. ICN190600, paratype; *F. spinescens* G. ICN97790, holotype; *F. sanctichampagnatii* H. ICN139202, paratype; *F. uncinata* I. ICN200561.

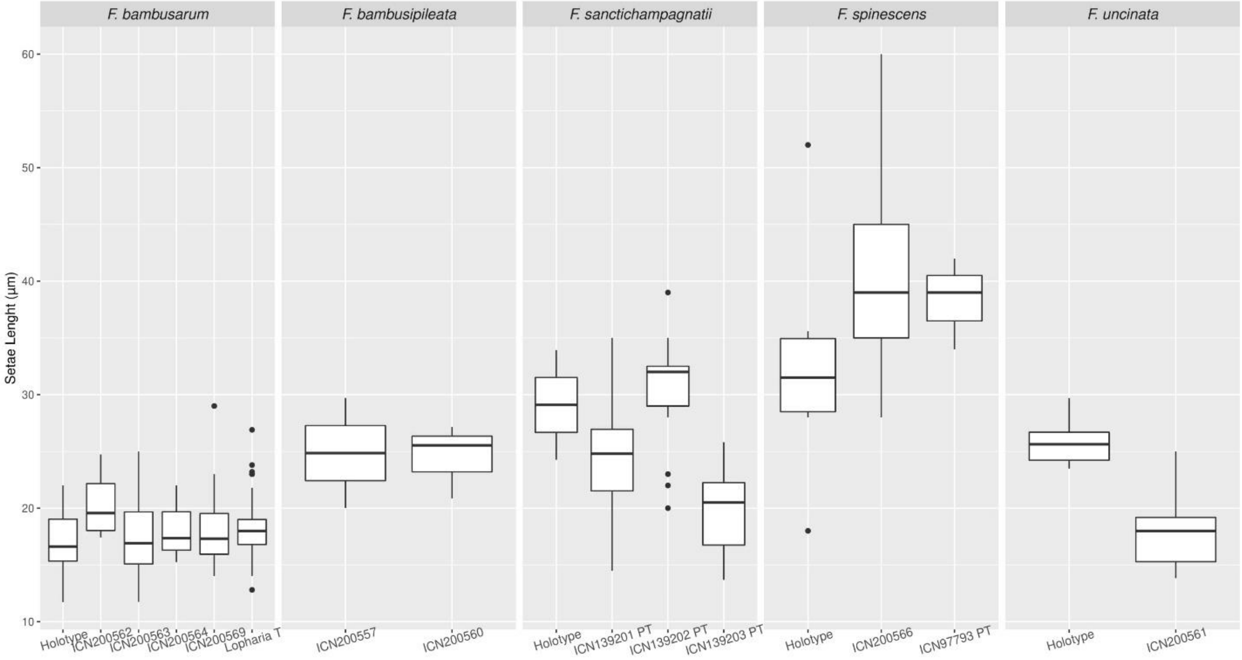
Supplementary Figure 3. Boxplot graphic based on setae length. For each taxon 25–75 percent quartiles are drawn using a box, median is shown with a horizontal line inside the box. The intervals represented by a dashed line corresponding to the largest value less than 1.5 times the box height and the smallest value less than 1.5 times the box height. Values outside these intervals are considered outliers and are represented as circles. Abbreviations of x-axis labels are as follows: T = holotype, PT = paratype.

Supplementary Table 1. Summary of nrITS, nrLSU, *TEF1* and *RBP2* sequences.

Supplementary Table 2. Morphological comparison. N/A means not available.


A
B
C
D
E
Madeira Province
Parana Forest Province
Atlantic Province
Araucaria Forest Province
Pampeam Province
0
500
1000 km


A
B
C
D
E
F
G
H
I


F. bambusarum
F. bambusipileata
F. sanctichampagnatii
F. spinescens
F. uncinata
Setae Lenght (µm)
60
50
40
30
20
10
Holotype
ICN200562
ICN200563
ICN200564
ICN200569
Lopharia T
ICN200557
ICN200560
Holotype
ICN139201 PT
ICN139202 PT
ICN139203 PT
Holotype
ICN200566
ICN97793 PT
Holotype
ICN200561

SUPPLEMENTARY TABLE 1 Summary of ITS, 28S, TEF1 and *RBP2* datasets.

Properties	Datasets											
	ITS1	5.8S	ITS2	28S	TEF1-1st	TEF1-2nd	TEF1-3rd	TEF1introns	*RPB2*-1st	*RPB2*-2nd	*RPB2*-3rd	Total
Model selected	HKY+G	K80	HKY+G	GTR+I+G	GTR+I+G	F81+I	GTR+G	HKY+I+G	GTR+I+G	F81+I	GTR+I+G	
Likelihood score	–3,502.56	–314.62	–2,605.79	–3,008.88	–690.049	–517.57	–3,245.35	–1,931.31	–774.72	–495.53	–4,812.25	
Base frequencies												
Freq. A =	0,2918	Equal	0,2527	0,2628	0,2945	0,3122	0,155	0,291	0,27	0,3066	0,2118	
Freq. C =	0,1801	Equal	0,1766	0,2012	0,1913	0,2473	0,3204	0,1885	0,2364	0,1825	0,1969	
Freq. G =	0,1946	Equal	0,2042	0,2948	0,3737	0,155	0,2348	0,1591	0,3453	0,2064	0,3075	
Freq. T =	0,3334	Equal	0,3664	0,2413	0,1405	0,2854	0,2898	0,3614	0,1483	0,3045	0,2837	
Proportion of invariable sites	–	–	–	0,6887	0,7793	0,9051	–	0,1554	0,6911	0,8408	0,0837	
Gamma shape	0,8971	–	0,586	0,6799	1,0312	–	1,9513	8,3741	0,9539	–	2,1456	
Final DNA sequence alignments (bp)		877		902		994		199		813		3785
Variable parsimony-uninformative positions		67		26		38		10		19		160
Variable parsimony-uninformative positions (%)		7,60%		2,90%		3,80%		5%		2,30%		
Parsimony-informative positions		371		123		238		120		263		1115
Parsimony-informative positions (%)		42,30%		13,60%		23,90%		60,30%		32,30%		
Parsimony-informative positions from total (%)		9,80%		3,25%		6,29%		3,17%		6,95%		29%

						Basidiospores				Setae		Pores					
						Measurement (length × width)		Q		Measurement (length × width)		by mm		Diam. (µm)		Dissepiment (µm)	
			Type	Source of the annotation	Host	Range (µm)	Ave. (µm)	Range (µm)	Ave. (µm)	Range (µm)	Ave. (µm)	Range (µm)	Ave. (µm)	Range (µm)	Ave. (µm)	Range (µm)	Ave. (µm)
F. bambusipileata	ICN	200557	Holotype	this study	*Merostachys* sp.	(4.5–)4.7–5.6(–6) × 4–5(–5.2)	5.10 × 4.49	1–1.2 (–1.25)	1,14	20–30 × 5(–9.5)	24.85 × 7.25	6–9 (–10)	7,80	(60–)78–151(–190)	117,11	30–100(–110)	52,50
F. bambusipileata	ICN	200560	Paratype	this study	*M. multiramea*	(4–)4.29–6.13(–6.63) × 4–5.19(–5.43)	5.27 × 4.54	1–1.4(–1.5)	1,17	20.86–27.15 × 4.75–5.17	24.52 × 4.96	6–8.3 (–9)	7,20	100–154(–160)	127,69	40–96(–110)	58,75
summary of *Fomitiporia bambusipileata*						**(4–)4.29–6.13(–6.63) × 4–5.19(–5.43)**	**5.18 × 4.51**	**1–1.4(–1.5)**	**1,15**	**20.86–30 × 4.75–5(–9.5)**	**24.68 × 6.10**	**6–9(–10)**	**7,50**	**(60–)78–160(–190)**	**122,40**	**30–100(–110)**	**55,63**
Lopharia. bambusae	PACA	13938	Holotype	this study	bamboo	(4.5–)4.55–5.6 × 4–5.6	5.01 × 4.65	1–1.2	1,08	(12.8–)14–23.3(–26.9) × (4.6–)5–8.6(–9)	18.28 × 6.44	8–10(–11)	9,23	NA	NA	NA	NA
Poria bambusarum	PACA	18570	Holotype	this study	bamboo	(4.24–)4.37–5.43(–5.72) × 4–5.13	4.92 × 4.59	1–1.25	1,07	(11.73–)13.65–21.4(–22) × 5.3–8.5(–9.55)	17.17 × 6.96	(6–)7–9	8,00	(145–)159–258(–270)	203,19	(49–)58.4–171(–222)	91,75
F. bambusarum	ICN	200562		this study	*M. multiramea*	4.14–4.21 × 4.12	4.18 × 4.13	1–1.02	1,01	17.42–24.73 × 5.77–6.89	20.30 × 6.46	8–9	8,20	NA	NA	NA	NA
F. bambusarum	ICN	200563		this study	*M. multiramea*	4.38–5.43 × (4.13–)4.36–5	4.95 × 4.78	1–1.09	1,04	(11.74–)13.42–22(–25) × (4.23–)4.57–7	17.33 × 5.49	(8–)8.9–11	9,67	NA	NA	NA	NA
F. bambusarum	ICN	200564		this study	bamboo	4.91–5.51 × 4.83–5.34	5.21 × 5.09	1–1.03	1,02	15.50–22.00 × 5–6	18.20 × 5.48	6–9	7,47	NA	NA	NA	NA
F. bambusarum	ICN	200569		this study	bamboo	5 × 5	5 × 5	1	1	14.21–23.9(–29) × (–5.52)5.7–8.18	16.8 × 6.6	(7–)8–11.6(–12)	9,23	NA	NA	NA	NA
summary of *F. bambusarum* (from *Poria bambusarum* (PACA18570))						**(4.24–)4.37–5.43(–5.72) × 4–5.13**	**4.92 × 4.59**	**1–1.09(–1.25)**	**1,07**	**(11.7–)13.7–21.4(–22) × 5.3–8.5(–9.6)**	**17.17 × 6.96**	**(6–)7–9**	**8,00**	**(145–)159–258(–270)**	**203,19**	**(49–)58.4–171(–222)**	**91,8**
F. uncinata	BAFC	29836	Holotype	Coelho et al. 2009	*Bambusa* sp.	5–6.5(–7) × 4.5–6(–6.5)	5.6 × 5.28	1–1.25	1.07	13–30 × 7–15	23.3 × 11.83	4–8	6.42	NA	NA	NA	NA
F. uncinata	BAFC	29836	Holotype	Rajchenberg 1987	*Bambusa* sp.	5.5–7 × 5–6.5	NA	NA	NA	25–35 × 6–12(–16)	NA	(4–)5–6	NA	NA	NA	NA	NA
F. uncinata	ICN	200561		this study	*M. multiramea*	4.79–5.72(–6) × 4.36–5.28(–6)	5.30 × 4.84	1–1.23	1,10	(13.83–)14.56–22.34(–25) × 6.19–9.36(–10)	18.1 × 7.6	(5–)6–9	7,33	NA	NA	NA	NA
summary of *F. uncinata* (from original description)						**5.5–7 × 5–6.5**	**NA**	**NA**	**NA**	**25–35 × 6–12(–16)**	**NA**	**(4–)5–6**	**NA**	**NA**	**NA**	**NA**	**NA**
F. sanctchampagnatii	ICN	139044	Holotype	this study	bamboo	(4.8–)5.49–6.2 × (4.7–)4.9–6	5.74 × 5.38	1–1.14	1,07	24.26–33.93 × 6–7.25	29.10 × 6.67	8–10(–11)	9,23	NA	NA	NA	NA
F. sanctchampagnatii	ICN	139203	Paratype	this study	bamboo	NA	NA	NA	NA	(13.68–)15.2–25.8 × 4–7.93	19.98 × 5.61	NA	NA	NA	NA	NA	NA
F. sanctchampagnatii	ICN	139201	Paratype	this study	bamboo	NA	NA	NA	NA	(14.48–)16.19–32.15(–35) × (4.5–)4.77–8(–8.39)	24.64 × 6.40	(3–)4–7	5,7	NA	NA	NA	NA
F. sanctchampagnatii	ICN	139202	Paratype	this study	bamboo	5–6 × 4.92–5.63(–5.73)	5.63 × 5.12	1–1.2	1,10	20–36.2(–39) × (5.32–)5.8–8.54(–9)	30.14 × 7.04	(4–)4.2–5.8(–6)	5	NA	NA	NA	NA
summary of *F. sanctchampagnatii*						**5–6(–6.2) × (4.7–)5–6**	**5.7 × 5.3**	**1–1.2**	**1,08**	**(13.7–)15.2–36.2(–39) × 4–8.5(–9)**	**25.9 × 6.4**	**(3–)4–10(–11)**	**6,64**	**NA**	**NA**	**NA**	**NA**
F. spinescens	ICN	200566		this study	bamboo	(4–)4.53–5.75(–6) × 4–5(–5.39)	5.08 × 4.69	1–1.25	1,09	(28–)30.2–54.2(–60) × (6–)6.72–9(–10)	40.11 × 7.68	4-6	4,9	NA	NA	NA	NA
F. spinescens	ICN	97790	Holotype	this study	bamboo	(4.87–)5.22–6.98(–8.2) × (4.31–)4.77–6.68(–7.83)	6.07 × 5.63	1–1.17	1,08	(18–)20.5–47.9(–52) × (–4)4.75–9.75(–10)	32.77 × 7.37	5-6	5,6	NA	NA	NA	NA
F. spinescens	ICN	97794	Paratype	this study	bamboo	5.48–6.53 × 4.88–5.76	6.07 × 5.33	1.05–1.22	1,14	NA	NA	NA	NA	NA	NA	NA	NA
F. spinescens	ICN	97793	Paratype	this study	bamboo	NA	NA	NA	NA	34–42 × 5–8	38.3 × 6.3	5-6.6(-7)	5,93	NA	NA	NA	NA
summary of *F. spinescens* (from holotype and paratype)						**5–7(–8) × (4–)4.5–6.5(–8)**	**6 × 5.5**	**1–1.22**	**1,11**	**(18–)20.5–47.9(–52) × (–4)4.8–9.8(–10)**	**35.53 × 6.83**	**5-6.6(-7)**	**5,77**	**NA**	**NA**	**NA**	**NA**

MANUSCRITO III — Neotropical *Fomitiporia* diversity revealed: nine new species and new records from Brazil based on multilocus phylogeny

Genivaldo Alves-Silva, Elisandro Ricardo Drechsler-Santos, Aristóteles Góes-Neto, Rosa Mara B. Silveira

Neotropical *Fomitiporia* diversity revealed: nine new species and notes on morphology and geographic distribution

G. Alves-Silva[1,*], E.R. Drechsler-Santos[2], A. Góes-Neto[3], R.M.B. da Silveira[1]

[1]Programa de Pós-Graduação em Botânica, Departamento de Botânica, Instituto de Biociências (IB), Universidade Federal do Rio Grande do Sul, Campus do Vale, CEP: 91501-970, Porto Alegre, Rio Grande do Sul, Brasil.

[2]Programa de Pós-Graduação em Biologia de Fungos, Algas e Plantas, Departamento de Botânica, Universidade Federal de Santa Catarina, Campus Universitário Trindade, CEP: 88040-900, Florianópolis, Santa Catarina, Brasil.

[3]Universidade Federal de Minas Gerais, Instituto de Ciências Biológicas (ICB), Departamento de Microbiologia, Laboratório de Biologia Molecular e Computacional de Fungos (LBMCF), Av. Antônio Carlos, 6627, CEP 31270-901, Belo Horizonte, MG, Brasil.

*Corresponding author: G. Alves-Silva (genivaldobio@gmail.com)

ABSTRACT

Fomitiporia (Hymenochaetales, Basidiomycota) is a genus of wood-inhabiting species with difficult species delimitation. The species are characterized mainly by basidiospore traits (hyaline, dextrinoid, strongly cyanophilous, globose to subglobose in shape), the presence of hymenial setae in some species, dimitic hyphal system, and resupinate to pileate basidiomata. Based only in morphological approach the species were broadly circumscribed and widely distributed. On the other hand, there is a trend for more restricted morphological circumscriptions and geographic distribution based on integrative taxonomy (morphological, molecular, and ecological data). In this study, we performed morphological and molecular (nrITS, nrLSU, *TEF1*, and *RPB2*) analyses and provided ecological data in order to understand the species boundaries and phylogenetic relationships. All specimens were recovered in single clade (Neotropical), subdivided in at least six minor clades including and nine unknown lineages, here proposed as new species: *F. rhizophila* ad int. sp. nov., *F. elliptica* ad int. sp. nov., *F. exigua* ad int. sp. nov., *F. pulvinata* ad int. sp. nov., *F. rondoni* ad int. sp. nov., *F. biformis* ad int. sp. nov., *F. puiggarii* ad int. sp. nov., *F. melanoderma* ad int. sp. nov., and *F. prolongata* ad int. sp. nov.. Also, the species *F. castilloi* and *F. impercepta* are reported for the first time in Brazil A dichotomic key for Neotropical species is provided. Furthermore, morphological analyses were carefully aligned to ecological data (fungal-host relationships and geographic distribution) and molecular phylogeny to evidence cryptic species and this demonstrated being crucial on species boundaries understanding.

KEY WORDS

Agaricomycetes, cryptic species, Funga, Hymenochaetaceae, Neotropical fungi, polypores, 9 new taxa

INTRODUCTION

Since *Fomitiporia* was assessed and reestablished in a monophyletic group (Fischer 1996), the diversity of the genus has been observed to be much higher than previously expected (David et al. 1982; Ryvarden and Gilbertson 1994). About 65 species are currently recognized (Index Fungorum 2020) in the genus and more than 50% were described worldwide only in the last 10 years (e.g. Amalfi et al. 2010, 2012; Vlasák and Kout 2011; Amalfi and Decock 2013; Campos-Santana et al. 2014; Chen et al. 2016; Li et al. 2016; Morera et al. 2017; Liu et al. 2018; Rajchenberg et al. 2019; Alves-Silva et al. 2020a, b; Tchoumi et al. 2020).

Fomitiporia species are characterized mainly by basidiospore traits (hyaline, dextrinoid, strongly cyanophilous, globose to subglobose in shape), the presence of hymenial setae in some species, a dimitic hyphal system, and resupinate to pileate basidiomata (Decock et al. 2007; Dai 2010). Most of closely related lineages present no evident morphological differences and integrative approaches are crucial for species delimitations. Therefore, critic morphological analysis, multilocus phylogenies and ecological data have been supporting recent studies on morphological species complexes (Morera et al. 2017; Alves-Silva et al. 2020b).

Both resupinate and pileate species present lineages hard to distinguish. Mostly from Neotropics, the resupinate species, which are phylogenetically grouped in Neotropical clade, are separated mainly by comparing the basidiospores size and pseudopileate basidiomata robustness (e.g. *F. dryophila* and *F. chilensis*); how many effused is (e.g. *F. expansa* and *F. neotropica*); and the number of tube layers as well (*F. neotropica* vs. *F. impercepta*) (Decock et al. 2007; Amalfi and Decock 2014; Campos-Santana et al. 2014; Morera et al. 2017; Rajchenberg et al. 2019).

Fomitiporia apiahyna s.lat. and *F. langloisii* group are important morphological species complexes, the former present species with pileate species and the last resupinate basidiomata, both have been recovering in the Neotropical clade in last phylogenies (Decock et al. 2007; Amalfi and Decock 2013; Morera et al. 2017; Alves-Silva et al. 2020b). Concerning resupinate species, Decock et al. (2007) reestablished *F. langloisii*, *F. dryophila*, and *F. maxonii*. Moreover, recently, closely related species were proposed from difficult morphological delimitations scenarios (Campos-Santana et al. 2014; Morera et al. 2017). Amalfi and Decock (2013) addressed pileate species in Neotropics and unveiled at least five lineages in *F. apiahyna* sensu lato (s.lat.), in which recently Alves-Silva et al. (2020b) established *F. apiahyna* sensu stricto (s.str.) and proposed three new species based on integrative taxonomy and ecological data with great importance for species boundaries.

In Brazil, until recently, there were only nine *Fomitiporia* species reported (*F. apiahyna*, *F. bambusarum*, *F. dryophila*, *F. maxonii*, *F. neotropica*, *F. sanctichampagnatii*, and *F. spinescens*) (Coelho et al. 2009; Abrahão et al. 2012; Campos-Santana et al. 2014, 2015), in addition to *F. punctata* and *F. robusta*, commonly assigned incorrectly to specimens with, respectively, resupinate and pileate basidiomata (see Decock et al. 2007; Vlasák and Kout 2011). *Fomitiporia atlantica* and *F. subtilissima* were latter described with distinctly macromorphological traits in comparison to morphological species complexes as *F. apiahyna* (Li et al. 2016). More recently, Alves-Silva et al. (2020a) found an exclusive clade of *Fomitiporia* species occurring on bamboo species and proposed a new pileate species for this group. Furthermore, Alves-Silva et al. (2020b) assessing species boundaries in *F.*

apiahyna s.lat. circumscribed *F. apiahyna* s.str. and described three new species (*F. conyana*, *F. murrilli*, and *F. nubicola*).

Although some progress towards the recognition of the diversity of *Fomitiporia* in Neotropics has been achieved, some species complexes are still lacking morphological, geographical and phylogenetic delimitation (e.g. *F. apiahyna* s.lat.) as well as underexplored areas may potentially harbor undescribed species. In order to understand species delimitations of abovementioned morphological complexes and clarify the geographical range (endemic vs. widely distributed) of *Fomitiporia* species, we carried out extensive field expeditions in Brazil and provided critic morphological analysis and multilocus phylogeny, as well as ecological data.

MATERIAL AND METHODS

Taxon sampling, geographic distribution and morphological analysis

Geographic distributions are presented according Neotropical regionalization proposed by Morrone (2014). Specimens were collected in the Boreal Brazilian, Chacoan, Parana, and Southeastern Amazonian domains, including Araucaria Forest, Atlantic, Cerrado, Imerí, Pampean, Parana Forest, Roraima, and Xingu-Tapajós Provinces. All specimens have been deposited at ICN. Herbarium codes follow Thiers (2020). To construct the identification key, features from species not studied here were obtained from protologues and/or from type studies.

Basidiomata colors were described according to Kornerup and Wanscher (1978). Free-hand sections of basidiomata were examined in Melzer’s reagent, Cotton Blue (CB) in lactic acid, neutral lactophenol, 3% KOH, and 1% phloxine plus KOH to check dextrinoidity, cyanophily, natural colors, and xanthocroic reactions (Largent et al. 1977; Ryvarden 1991; Kirk et al. 2008). All microscopic measurements (n = 40) were made in Melzer's. The size of microscopic elements is given as values (or an interval) followed by 5% variation in parentheses, if pertinent. In the text the following abbreviations were used: ave = average, diam = diameter, Q = the range of the ratio length/width, and Qm = the mean of the ratio length/width from basidiospores measurements. The microstructures description was according to Kirk et al. (2008).

DNA extraction, PCR amplification and Sequencing

Dried basidiomata samples were used for DNA extraction following Góes-Neto et al. (2005). Primer pairs ITS8F-ITS6R (Dentinger et al. 2010) and LR0R-LR7 (Vilgalys and Hester 1990; Cubeta et al. 1991) were used to amplify nuc rDNA ITS1-5.8S-ITS2 (ITS) and nuc rDNA 28S (28S), respectively. A fragment between exons 4 and 8 of the translation elongation factor 1-alpha (*TEF1*) (Wendland and Kothe 1997) was amplified with the primer pair 983F-2212R (Rehner and Buckley 2005). We also amplified and sequenced the most variable region of RNA polymerase II second largest (*RPB2*) using primers b6F and b7.1R (Frøslev et al. 2005; Matheny 2005). Polymerase chain reaction (PCR) was performed with a total volume of 40 µL containing 20 µL of 2X PCR Taq MasterMix (Applied Biological Material, Vancouver, Canada), 0.8 µL of primer (10 pM), 1 2 µL of DNA, and q.s. sterile distilled water. All PCR products were purified with PEG 20% [Poly(ethylene glycol) 8,000 plus NaCl 2.5M], and then were sequenced with a BigDye Terminator 3.1 Cycle Sequencing Kit (Applied Biosystems, Foster City, California) following manufacturer procedures. For sequencing the primer pairs 1567R-2212R (Rehner and Buckley 2005) and LR0R-LR5 were used for *TEF1* and 28S, respectively. Sequencing was performed at the Centro de Pesquisas René Rachou from FIOCRUZ (Belo Horizonte, Brazil).

Phylogenetic analysis

Sequences were assembled and manually corrected in Geneious 9 (Kearse et al. 2012), then automatically aligned with MAFFT 7 (Katoh and Standley 2013) under the auto mode strategy. Where necessary, alignments were manually adjusted in MEGA 7 (Kumar et al. 2016). Also, in MEGA 7, for protein coding gene sequences, the assignment of codon positions was confirmed by translating nucleotide sequences into predicted amino acid sequences.

We provided two datasets, a combined: ITS+28S+*TEF1*+*RPB2* and another with ITS sequences only. The combined dataset was subdivided into 11 data partitions: ITS1 + 5.8S + ITS2 + 28S + *TEF1*-1st + -2nd + -3rd codon positions + *TEF1* introns + *RPB2*-1st + -2nd + -3rd codon positions (including 12-first positions of intron 4). While, the single dataset was three data partitions: ITS1 + 5.8S + ITS2. All individual datasets were analyzed separately. When comparing ML bootstrap and tree topologies obtained for the individual datasets, no conflict involving significantly supported nodes was found and we combined them. Alignments were deposited at TreeBASE (to be provided).

Phylogenetic analyses were performed online at the CIPRES Science Gateway (Miller et al. 2011). We analyzed the data sets separately using maximum likelihood (ML) and Bayesian inference (BI) approaches. ML analysis was carried out in RAxML 8.2.9 (Stamatakis 2014). The analysis first involved 100 ML searches, each starting from one randomized stepwise addition parsimonious tree under a GTRGAMMAI model, with all parameters estimated by the software. We provided a partition file to force RAxML software to search for a separate evolution model for each partition. To access the reliability of nodes, we computed the rapid bootstrapping replicates under the same model, allowing the program to halt bootstrapping automatically by extended majority rule (MRE)-based bootstopping criterion (Pattengale et al. 2009). Bootstrap (BS) values above 90% were considered significant (high support) and above 70% were considered moderate support.

Bayesian inference was performed in MrBayes 3.2.6 (Ronquist et al. 2012). Evolutionary models for BI were estimated using the AIC (Akaike Information Criterion) for each partition as implemented in MrModeltest 2.3 (Nylander 2004). The best-fit models for each partition were implemented as partition-specific models within partitioned mixed-model analyses (SUPPLEMENTARY TABLE 1). We set two independent runs, each with four simultaneous chains, for 50 million generations, sampling trees every 100th generation. The convergence diagnostic was calculated every 10 000th generation, and its critical value was set to stop the analysis automatically when the standard deviation of the split frequencies reached the value defined by the stopval command (stoprule = yes, stopval = 0.01). The first 25% of trees from each run were discarded as a burn-in, and the 50% majority-rule tree with branch lengths and posterior probabilities (BPP) was calculated from the remaining trees. A BPP value above 0.99 was considered significant. We used *Phellinus uncisetus* as an outgroup based on previous studies (Amalfi et al. 2010, 2012, 2014; Amalfi and Decock 2013). All materials and sequences used in this study are listed in TABLE 1. All *Fomitiporia* sequences are available in GenBank.

RESULTS

Molecular phylogenetic analyses

For this study, we provided 116 new sequences, about 30 from each DNA region. The final DNA sequence alignments, variable parsimony-uninformative positions, and parsimony-informative positions are listed in the SUPPLEMENTARY TABLE 1. From the single dataset we carried out only ML analysis and it was provided mainly for understanding the phylogenetic position of specimens with only ITS was available (SUPPLEMENTARY FIG. 1). A total of 220 specimens representing 70 (69 ingroup) species or potential species/clades were recovered from combined dataset. The combined dataset (ITS+28S+*TEF1*+*RPB2*) resulted in a 3,827 bp aligned matrix. All pertinent information about the 11 partitions are summarized in the SUPPLEMENTARY TABLE 1.

In Bayesian analysis, after 11,950,000 generations, runs converged to stable likelihood values (−lnL = 36,458.23 and 36,469.41), and 179,252 stationary trees were used to compute a 50% majority-rule consensus tree and to estimate BPPs of internodes. From the ML searches with RAxML, the combined alignment had 2,302 distinct patterns with a proportion of gaps and undetermined characters of 14.31%. The bootstopping criteria of RAxML indicated 252 pseudo replications as sufficient to determine internal branch support and the final ML optimization likelihood was −lnL = 36,078.6. No topological conflict involving significantly supported nodes was found; therefore, both BS and BPP values were superimposed in the best-scoring ML tree (FIG. 1).

The relationships mentioned below are from combined dataset analyses and were moderately to fully supported (BS ≥ 70%, BPP ≥ 0.99). Neotropical *Fomitiporia* species were recovered in a single clade, in which seven minor clades were retrieved, named and composed as follows: (1) *F. texana* clade, with four lineages, three unknown and one corresponding to a new species proposed here; (2) *F. langloisii–F. castilloi* clade, that includes mostly resupinate species and comprises four new species proposed here, two resupinate and two pileate; (3) *F. elegans* clade composed only for *F. elegans*; (4) Andean clade is composed by two species from altitudinal forests in Andes; (5) *F. biformis* ad int. clade there is one unknown lineage described here as new species; (6) *F. atlantica–F. subtilissima* clade comprises three recovered lineages, one of them corresponding to a new species proposed here; and (7) *F. apiahyna* s.lat. clade, a morphological species complex, in which at least nine lineages were placed together and two species are proposed.

TAXONOMY

Fomitiporia melanoderma ad int. Alves-Silva, R.M. Silveira & Drechsler-Santos, **sp. nov.**

FIGS. 1, 2

MycoBank (to be provided)

Typification: BRAZIL, Bahia: Camacã, RPPN Serra Bonita, Tower trail, 15°23'14.0"S 39°33'50.9"W, 900 m.a.s.l., on dead standing unidentified angiosperm, 18 Sep 2016, *G. Alves-Silva* 893 (ICN).

Etymology: melanoderma ad int. (Latin), in reference to the black superior surface.

Description: Basidiomata perennial, pileate, sessile, narrowly attached, semicircular, solitary, triquetrous to applanate, occasionally with a basal umbo, projecting 27–170 mm, 35–115 mm wide and 27–59 mm thick, consistency hard corky to woody. Pileus glabrous, concentrically zonate with multiple narrow bands, sometimes interleaved with broad bands, moderately sulcate, cracked with age, dull, first light brown, golden brown, yellowish brown

[5DE(5–8)] becoming black, superior surface as a hard and dark crust. Margin obtuse, round, slightly folded, thick, sterile, first light yellow (4A5), olive yellow [4C(6–8)], greyish yellow, dark yellow [4C(6–8)] becoming brown [5E(5–8)]. Pore surface brown [5E(5–8)]; pores round to angular, 4–5(–6) per mm, (234–)241–368(–385) µm diam. (ave = 306 µm); dissepiments entire, (74–)79–229(–283) µm (ave = 149.5 µm) thick. Tubes distinct stratified, with several layers (up to 10 layers), interleaved with thin context, individual tube layers up to 3 mm thick, brownish yellow [5C(7–8)], brown [5E(6–8)], to grayish brown (5E3), the older layers filled with whitish mycelium. Context simple, up to 4 mm thick, with dense texture and woody consistency, brownish yellow to brownish orange [5C(6–8)].

Hyphal system dimitic in all parts; generative hyphae simple septate, hyaline to pale yellow, sparingly branched, 1.5–2.5 µm diam.; skeletal hyphae golden brown to reddish brown, unbranched, thick-walled, occasionally with local swelling 6–6.5 µm diam., in the context (3–)3.5–5(–5.5) µm diam., the lumen 1–2.5(–3) µm wide and hymenophoral trama 3–4.5(–5) µm diam., the lumen 1–2(–2.5) µm wide. Hymenial setae absent. Cystidioles rare, fusoid, lanceolate, hyaline, thin-walled. Basidia subglobose to globose, hyaline, tetrasporic, 8–9.5 × 7–8 µm (ave = 8.8 × 7.6 µm), Q = 1–1.4 µm (aveQ = 1.15 µm); basidioles identical in shape but slightly smaller than basidia. Basidiospores subglobose to globose, 4.5–6 × 4–5.5(–6) µm (ave = 5 × 4.5 µm), Q = 1–1.2(–1.3) µm (aveQ = 1.11 µm), hyaline, moderately to strongly dextrinoid, cyanophilous, thick-walled, smooth. Crystals rhomboid, of variable size.

Physiology, substrate, habitat, and known distribution: white-rot fungus, dead standing unidentified angiosperm, Lesser Antilles Province in Guadalupe island, Guianan Lowlands Province in French Guiana and Atlantic Province in Bahia state, Brazil.

Comments: *Fomitiporia melanoderma* ad int. is characterized mainly by having pileate, sessile, narrowly attached, solitary, triquetrous to applanate basidiomata and superior surface as a hard and dark crust. Microscopically, basidiospores are subglobose to globose, 5 × 4.5 µm on average. Phylogenetically, this species was recovered nested within *F. apiahyna* s.lat., sister to *F. conyana* and *F. murrilli*. *Fomitiporia murrilli* differs by having slightly bigger basidiospores, 6 × 5.3 vs. 5 × 4.5 µm on average and *F. conyana* by having smaller pores, 6–8(–9)/mm vs. 4–5(–6) (Alves-Silva et al. 2020b). Regarding other species in *F. apiahyna* s.lat., *F. melanoderma* ad int. appears to be widely distributed in Neotropics, whereas *F. apiahyna*, *F. nubicola*, and *Fomitiporia* sp. PS4 have restricted occurrence, the two first are found mostly in Araucaria Forest Province, at 800–1,000 m.a.s.l. and 1,000–1,700 m.a.s.l., respectively, and the latter occurs in Mexico (Amalfi and Decock 2013).

Fomitiporia prolongata ad int. Alves-Silva, R.M. Silveira & Drechsler-Santos, **sp. nov.**

FIGS. 1, 3

MycoBank (to be provided)

Typification: BRAZIL, Paraná: Matinhos, Parque Nacional Saint-Hilaire/Lange, 25°40'23.7"S 48°35'48.7"W, 190 m.a.s.l., on dead stump, 7 Jun 2017, *G. Alves-Silva* 1139 (ICN).

Etymology: prolongata ad int., from *prolongatus* (Latin) = lengthened, in reference to projection of basidiomata forward, in which the deposition of each tube layer does not fully cover the precedent.

Description: Basidiomata perennial, pileate, sessile, semicircular, applanate, rare ungulate, rare concave, obtriquetrous to triquetrous, from substrate, moving away progressively tube layer by tube layer, each them evidently forward, which do not cover near the base the precedent layer, projecting 12–73 mm, 11–73 mm wide and 11–55 mm thick, with a woody consistency. Pileus glabrous, concentrically zonate with multiple narrow bands and sometimes interleaved with up to 8 broad bands, moderately to strongly sulcate, faintly to strongly cracked with age, indurating black crust with age, dull, first brownish yellow [5C(7–8)], light brown, golden brown [5D(6–8)], ferruginous brown, olive brown [6D(6–8)] becoming brown [5–6E(6–8)] to black. Margin round, folded, acute to obtuse, sterile, up to 2 mm wide, deep yellow (4A8), light yellow [4A(4–5)], golden brown to light brown [5D(6–8)] near to pores. Pore surface greyish brown (5E3) to brown [5EF(4–8)]; pores round to angular, (4–)5–8/mm, (169–)182–332(–354) µm diam. (ave = 240.6 µm); dissepiments entire, (65–)82–278(–304) µm (ave = 145.5 µm) thick. Tubes distinct to mostly indistinctly stratified, with several layers, interleaved with context in older tube layers, brown [5EF(4–8)] to grayish brown (5E3), the older layers filled with whitish mycelium. Context simple, up to 2 mm thick, with dense texture and with a woody consistency, brownish orange [6C(7–8)], light brown to brown [6DE(7–8)], with a distinct dark line near to surface.

Hyphal system dimitic in all parts; generative hyphae simple septate, hyaline to pale yellow, sparingly branched, 2–3 µm diam.; skeletal hyphae golden brown to reddish brown, unbranched, thick-walled, in the context (3–)3.5–4.5(–5) µm diam., the lumen 1–2.5(–3) µm wide and hymenophoral trama (2.5–)3–4 µm diam., the lumen 1–2(–2.5) µm wide. Hymenial setae absent. Cystidioles rare, fusoid, lanceolate, hyaline, thin-walled. Basidia subglobose to globose, barrel-shaped, pyriform, hyaline, tetrasporic, (8–)8.5–11(–12.5) × 6.5–9 µm (ave = 9.5 × 7.5 µm), Q = 1–1.6(–1.9) µm (aveQ = 1.23 µm); basidioles identical in shape but slightly smaller than basidia. Basidiospores subglobose to globose, 4.5–6(–6.5) × (4–)4.5–

5.5(–6) µm (ave = 5.2 × 4.7 µm), Q = 1–1.3(–1.4) µm (aveQ = 1.1 µm), hyaline, moderately to strongly dextrinoid, cyanophilous, thick-walled, smooth. Crystals rhomboid, of variable size.

Physiology, substrate, habitat, and known distribution: white-rot fungus, dead unidentified angiosperms, Napo Province in Ecuador, Guianan Lowlands Province in French Guiana, Atlantic Province in Bahia and Paraná states, and Roraima Province in Roraima state, Brazil.

Comments: *Fomitiporia prolongata* ad int. is characterized mainly by having pileate, applanate, obtriquetrous to triquetrous basidiomata with successive deposition of each tube layer forward, which does not cover near the base the precedent one. Microscopically, basidiospores are moderately to strongly dextrinoid, 5.2 × 4.7 µm on average. Phylogenetically, *F. prolongata* ad int. grouped within *F. apiahyna* s.lat., sister to clade composed by *F. melanoderma* ad int., *F. murrilli*, *Fomitiporia* sp. PS1, *Fomitiporia* sp., and *F. conyana*. *Fomitiporia prolongata* ad int. differs of all pileate species (except *F. subtilissima*) by having different tube layers deposition (FIG. 3), with prominent and mostly thin basidiomata, which in some specimens appear to have a pseudostipe. *Fomitiporia subtilissima* differs by having smaller basidiospores, 4–5 × 4–4.5(–5) µm vs. 4.5–6(–6.5) × (4–)4.5–5.5(–6) µm (Li et al. 2016).

Additional specimens examined: BRAZIL, Bahia: Camacã, RPPN Serra Bonita, Tower trail, at the base of living unidentified angiosperm, 18 Sep 2016, *G. Alves-Silva* 880 (ICN); ibid., 884 (ICN); ibid., 15°23'23.6"S 39°33'57.6"W, 900 m.a.s.l., on dead stump, 17 Sep 2016, *G. Alves-Silva* 859 (ICN); ibid., Uruçuca, Parque Estadual Serra do Condurú, 14°29'40.9"S 39°08'01.8"W, on dead inclined unidentified angiosperm, 19 Sep 2016, *G.*

Alves-Silva 903 (ICN); ibid., 14°29'40.9"S 39°08'01.8"W, 630 m.a.s.l., on standing dead unidentified angiosperm, 20 Sep 2016, *G. Alves-Silva* 915 (ICN); ibid., 14°29'40.9"S 39°08'01.8"W, on dead stump, 19 Sep 2016, *G. Alves-Silva* 896 (ICN); ibid., Pará: Belém, Mata do Utinga, on dead trunk (*Aniba* sp., Lauraceae), 14 Mar 1978, *M.A. Souza & M.G. Silva* 371 (INPA84110).

Fomitiporia puiggarii ad int. Alves-Silva & Drechsler-Santos, **sp. nov.** FIGS. 1, 4

MycoBank (to be provided)

Typification: BRAZIL, São Paulo: Apiaí, Parque Natural Municipal Morro do Ouro, 24°31'13.25"S 48°50'11.13"W, on dead standing unidentified angiosperm, 13 Dec 2014, *G. Alves-Silva* 674 (FLOR 58555).

Etymology: puiggarii ad int., named in honor of Juan Ignacio Puiggari, due to his contribution to the Brazilian mycology, beginning cryptogamic collections in São Paulo about 1880.

Description: Basidiomata perennial, pileate, sessile, broadly attached, applanate, triquetrous to obtriquetrous, projecting 16–44 mm, 16–58 mm wide and 19–21 mm thick at the base, with a woody consistency. Pileus glabrous concentrically zonate with multiple narrow bands, up to 4 broad bands, moderately sulcate, brown [6E(5–8)], brownish yellow [5C(7–8)] to dark brown [6F(5–8)]; margin round, sterile, deep yellow (4A8) to brownish yellow [5C(6-8)] when young to dark brown [6F(4–8)]. Pore surface grayish brown (6F3), brownish grey (6E3), cinnamon to brown [6E(6–7)]; pores round to angular, lacerate mostly near to margin, (3–)4–8/mm, (100–)110–160(–170) µm diam. (ave = 130.5 µm); dissepiments entire, 30–110(–150) µm (ave = 62.3 µm) thick. Tubes distinctly stratified, with up to 8 distinct layers, individual layers up to 2 mm thick, with thin context among layers, golden yellow (5B7), greyish brown (5E3) to cinnamon, the older layers filled with whitish mycelium. Context simple, zonate, up to 4 mm thick, with dense texture and woody consistency, golden yellow (5B7), greyish orange [5B(5–6)], brownish orange [6C(6–8)] to dark brow [6DE(7–8)], with a dark line near to surface.

Hyphal system dimitic in all parts; generative hyphae simple septate, hyaline to pale yellow, sparingly branched, (1.5–)2–3 µm diam.; skeletal hyphae yellowish brown to reddish brown, unbranched, thick-walled, occasionally with local swelling up to 6 µm diam., in the context and hymenophoral trama 3–5 µm diam., the lumen 1–3 µm wide; hyphae in the dissepiments thick-walled and yellowish ending thin-walled and hyaline. Hymenial setae absent. Cystidioles fusoid, lanceolate, hyaline, thin-walled, (8–)9–15(–17) × 4–6(–8) µm (ave = 10.9 × 5 µm). Basidia subglobose to globose**,** hyaline, tetrasporic**,** 8–11.5 × 6–7 µm (ave = 10.7 × 6.8 µm), Q = 1.35–1.7 µm (aveQ = 1.6 µm); basidioles identical in shape but slightly smaller than basidia. Basidiospores subglobose to globose, (4–)5–6 × 4.5–5(–6) µm (ave = 5.5 × 4.9 µm), Q = 1.0–1.25(–1.3) µm (aveQ = 1.11 µm), hyaline, strongly dextrinoid, strongly cyanophilous, thick walled, smooth. Crystals rhomboid, of variable size.

Physiology, substrate, habitat, and known distribution: white-rot fungus, dead unidentified angiosperms, Brazil in Atlantic and Parana Forest Provinces in Paraná and São Paulo states, respectively.

Comments: Fomitiporia puiggarii ad int. is mainly characterized by having pileate, applanate to triquetrous, and thin basidiomata; concentrically zonate with multiple narrow bands and moderately sulcate pileus. Microscopically, basidiospores are strongly dextrinoid, 5.5 × 4.9 µm on average. This species was recovered in the phylogeny nested within *F.*

subtilissima–*F. atlantica* clade and sister to *F. atlantica* (SUPPLEMENTARY FIG. 1). *Fomitiporia puiggarii* ad int. differs of closely related species by having slightly bigger basidiospores (on average 5.5× 4.9 µm vs. *F. atlantica*: 5.1× 4.8 µm and *F. subtilissima*: 4.5 × 4 µm), in addition *F. atlantica* differs by having nodulose pileus and broadly attached basidiomata and *F. subtilissima* by having applanate basidiomata and successive deposition of tube layers forward similarly *F. prolongata* ad int. (Li et al. 2016). From other pileate species, *F. puiggarii* ad int. differs by having greyish brown hymenophore and big pores, with occasionally laceration, 3–5 pores/mm (range: 4–8 pores/mm) (FIG. 4D).

Additional specimen examined: BRAZIL, Paraná: Piraquara, Morro do Canal, 25°30'57.1"S 48°59'04.2"W, 23 Jan 2016, *M. A. Reck* 1247 (ICN).

Fomitiporia atlantica Alves-Silva, Reck & Drechsler-Santos, Fungal Diversity 78: 165 (2016)

MycoBank: MB551915

Description: See Li et al. (2016).

Physiology, substrate, habitat, and known distribution: white-rot fungus, dead standing unidentified angiosperm, Brazil in Atlantic Province in Santa Catarina state and Pampean Province in Rio Grande do Sul state.

Comments: Fomitiporia atlantica is mainly characterized by having nodulose, imbricate, and broadly attached basidiomata and olivaceous brown pileus. Microscopically, it has slightly to strongly dextrinoid basidiospores, 5.1 × 4.8 µm on average. Phylogenetically, it has been recovered sister to *F. subtilissima*. In this study we extended geographic distribution of this species to Pampeam Province, however further collections should confirm this record, because it was based on an old collection, from locality which is currently an urban area. *Fomitiporia atlantica* differs from all pileate species by having mostly nodulose, imbricate, and broadly attached basidiomata and olivaceous brown pileus (Li et al. 2016).

Specimens examined: BRAZIL, Rio Grande do Sul, Montenegro, São Salvador, 21 Apr 1944, *Rick, J.* (PACA 20957); ibid., Santa Catarina, Blumenau, Parque Natural Municipal São Francisco de Assis, 26°55′17″S 49°04′18″W, on dead cut tree, 21 November 2014, *G. Alves- Silva* 640, (**holotype:** FLOR 58554); ibid., on dead standing trunk, 15 September 2015, *F. Bittencourt* 507 (FURB 47591); ibid., on dead unidentified angiosperm, 19 Jan 2016, *F. Bittencourt* 687 (FURB 48931); ibid., 27 Jan 2016, *F. Bittencourt* 724 (FURB 51308); ibid., 28 Jan 2016, *F. Bittencourt* 763 (FURB 51342).

Fomitiporia subtilissima Alves-Silva, Reck & Drechsler-Santos, Fungal Diversity 78: 168 (2016)

MycoBank: MB551916

Description: See Li et al. (2016).

Physiology, substrate, habitat, and known distribution: white-rot fungus, exposed dead roots of dead fallen tree (Lauraceae) and at the base of trees (e.g. type specimen on *Sloanea guianensis*), Brazil in Atlantic Province in Bahia and Santa Catarina states, Parana Forest Province in São Paulo state, and Roraima Province in Roraima state.

Comments: Fomitiporia subtilissima is mainly characterized by having thin, perennial basidiomata, with each new tube layer projecting forward, growing away from substrate. Microscopically, it has slightly to moderately dextrinoid basidiospores, 4.5 × 4 µm on average. *Fomitiporia subtilissima* was described based on specimens found growing at the base of living trees (Li et al. 2016). The new collections from Bahia and São Paulo reinforced its particular ecological features, as ICN200567 also was found at the base of a tree and ICN200568 on exposed roots of dead fallen tree. In addition, in this study, we extended *F. subtilissima* geographical distribution, which occurs also in Southeastern, Northeastern, and Northern Brazil, probably this species is widely distributed in Neotropics.

Specimens examined: BRAZIL, Santa Catarina: Blumenau, Parque Natural Municipal São Francisco de Assis, 26°55'17"S 49°04'19"W, 87 m.a.s.l., 28 Jul 2015, *F. Bittencourt* 493 (FURB47557: **holotype**); ibid., 30 Sep 2015, *F. Bittencourt* 588 (FURB48913); ibid., 29 Jan 2016, *F. Bittencourt* 742 (FURB51325); ibid., *F. Bittencourt* 743 (FURB52326); ibid., Bahia: Uruçuca, Parque Estadual Serra do Condurú, 14°29'40.9"S 39°08'01.8"W, 630 m.a.s.l., at the base of slanting dead tree, 19 Sep 2016, *G. Alves-Silva* 904 (ICN200567); ibid., Roraima: Parque Nacional do Viruá, L3 1500 30-40, on living unidentified angiosperm, 13 Nov 2009, *Jesus, M.A.* 6371 (INPA); ibid., São Paulo: Apiaí, Parque Natural Municipal Morro do Ouro, 24º31'16.2"S 48º50'14.5"W, 919 m.a.s.l., on exposed roots of dead fallen tree (Lauraceae), 6 Feb 2018, *G. Alves-Silva* 1276 (ICN200568).

Fomitiporia biformis ad int. Alves-Silva, R.M. Silveira & Drechsler-Santos, **sp. nov.**

FIGS. 1, 5

MycoBank (to be provided)

Typification: BRAZIL, Rio Grande do Sul: São Francisco de Paula, Floresta Nacional de São Francisco de Paula, 29°25'18.6"S 50°23'24.7"W, approx. 900 m.a.s.l., growing on dead stump, unidentified angiosperm, 26 Nov 2016, *G. Alves-Silva* 980 (ICN).

Etymology: biformis ad int. (Latin), in reference to two different basidiomata development stages: resupinate with effused to cushion-shaped basidiomata and pileate with broadly attached to ungulate basidiomata.

Description: Basidiomata perennial, the first layer(s) resupinate, cushion-shaped to effuse, becoming slightly triquetrous to ungulate in older ones; sessile to broadly attached; projecting 12–43 mm, 25–112 mm wide, and 10–190 mm thick when pileate and extending up to 500 mm long, 75 mm wide, and 16 mm in the thickest part when resupinate; with a woody consistency. Pileus glabrous, concentrically zonate with multiple broad bands, slightly sulcate, cracked mainly when older, first light brown [7D(5–8)] to brown [7E(5–8)], becoming dark brown [7F(5–8)] to black from the base. Margin round, folded, thick, sterile, pale yellow to light yellow [4A(3–5)] in young specimens, golden yellow (5B7) to brownish yellow [5C(7–8)] or yellowish brown [5D(6–8)]. Pore surface greyish brown, brownish beige (6E3) to cinnamon; pores round, (5–)6–7(–8)/mm, (105–)165–232(–260) µm diam. (ave = 197.8 µm); dissepiments entire, (42–)59–226(–256) µm (ave = 126.4 µm) thick. Context poorly developed, present only between the older layers. Tubes distinctly to indistinctly stratified, with up to 20 distinct layers, individual layers up to 3 mm thick, light brown to brown [6DE(6–8)], youngest (active) layer greyish brown (6E4), older layers filled with whitish mycelium. Subiculum brownish yellow [5C(7-8)], brown [5E(7–9)] to black, thin, up to 1 mm thick.

Hyphal system dimitic in all parts; generative hyphae simple-septate, hyaline to pale yellow, sparingly branched, 2–2.5(–3) µm diam; skeletal hyphae golden brown to reddish brown, unbranched, thick-walled, occasionally with local swellings [5.7–12(–14) µm diam], 3–4.5(–5) µm diam, the lumen 1–2 µm wide in the context, (2–)2.5–3(–3.3) µm diam, the lumen 1–2 µm wide in the hymenophoral trama. Hymenial setae absent. Cystidioles rare, fusoid, lanceolate, hyaline, thin-walled. Basidia subglobose to globose, barrel-shaped, hyaline, tetrasporic, 7.7–10 × 7.5–8.7 µm, (ave = 8.7 × 7.9 µm), Q = 1–1.2 µm, (Qm = 1.1 µm); basidioles identical in shape but slightly smaller than basidia. Basidiospores subglobose to globose, (4–)5–6(–7) × (4–)4.5–6(–7) µm (ave = 5.3 × 5 µm), Q = 1–1.2(–1.3) µm (Qm = 1.2 µm), hyaline, moderately to strongly dextrinoid and cyanophilous, thick-walled, smooth. Crystals rhomboid, of variable size.

Physiology, substrate, habitat, and known distribution: white-rot fungus, dead standing trunks and stumps and living unidentified angiosperms in altitudinal forests (800–1,000 m.a.s.l.), Brazil in Atlantic Province in Bahia state and Araucaria Forest Province in São Paulo and Rio Grande do Sul states.

Comments: Fomitiporia biformis ad int. is characterized mainly by having both resupinate and pileate basidiomata, besides mostly pileate specimens have short pilei (likely pseudopileate). Microscopically, it has strongly dextrinoid basidiospores with 5.3 × 5 µm on average. Phylogenetically, *F. biformis* ad int. was recovered sister to *F. apiahyna* s.lat.+*F. atlantica*–*F. subtilissima* clade and unrelated to *F. langloisii*–*F. castilloi* clade, in which all Neotropical resupinate species were recovered. *Fomitiporia biformis* ad int. differs from all pileate species by having short pilei and extended and broadly attached basidiomata (FIG. 5B, D). When resupinate, *F. biformis* ad int. is among bigger-pores species, together *F. chilensis*, *F. expansa*, and *F. impercepta*, they share (4–)5–7(–8) pores/mm. *Fomitiporia chilensis* differs by having bigger basidiospores 6.4 × 5.8 µm vs. 5.3 × 5 µm and mostly thicker basidiomata, up to 70 mm vs. 16 mm thick; *F. expansa* by having more extended (>100 cm) and thinner basidiomata (up to 5 mm thick), and *F. impercepta* by having slightly smaller pores [(77–)90–142(–167) vs. (105–)165–232(–260) µm diam.] and slightly thinner basidiomata (2–10 mm thick) (Amalfi and Decock 2014; Morera et al. 2017; Rajchenberg et al. 2019). *Fomitiporia biformis* ad int. when presents pseudopileate-like (broadly attached and short pilei) basidiomata is similar to *F. dryophila*, as Campos-Santana et al. (2015) have reported to southern Brazil (ICN 178860). However, *F. dryophila* differs by having bigger basidiospores (*F. dryophila*: 7 × 6.5 vs. 5.3 × 5 µm on average) and continental-USA distribution while *F. biformis* ad int. appears to be restricted to altitudinal forests (800–1,000 m.a.s.l.) in Atlantic forest composition, more specifically in Araucaria Forest and Atlantic Provinces.

Additional specimens examined: BRAZIL, Bahia: Camacã, RPPN Serra Bonita, Tower trail, 15°23'14.0"S 39°33'50.9"W, 900 m.a.s.l., on dead part of living unidentified angiosperm, 18 Sep 2016, *G. Alves-Silva* 890 (ICN); ibid., on below dangling dead unidentified angiosperm, 18 Sep 2016, *G. Alves-Silva* 891 (ICN); ibid., Rio Grande do Sul: São Francisco de Paula, Floresta Nacional São Francisco de Paula, 29°25'18.6"S 50°23'24.7"W, 900 m.a.s.l., on dead stump, 11 Jun 2016, *G. Alves-Silva* 826 (ICN); ibid., 913 m.a.s.l., on dead standing unidentified angiosperm, 26 Nov 2016, *G. Alves-Silva* 978 (ICN); ibid., 29°25'22.4"S 50°23'11.2"W, on dead unidentified angiosperm, 7 Jun 2010, *M. Campos-Santana* 192 (ICN 178860); ibid., Hotel Veraneio Hampel, 29°26'38.9"S 50°36'50.1"W, 900 m.a.s.l., on dead standing unidentified angiosperm, 23 May 2016, *G. Alves-Silva* 811 (ICN); ibid., 25 Jun 2017, *V. Oliveira-Garcia* 159 (ICN); São Paulo: Apiaí, Parque Natural Municipal Morro do Ouro, 24°30'44.8"S 48°49'49.2"W, 800 m.a.s.l., on dead stump, 13 Dec 2014, *G. Alves-Silva* 669 (ICN); ibid., 24°30'44.5"S 48°49'04.0"W, 970 m.a.s.l., on dead fallen trunk, unidentified angiosperm, 07 Feb 2018, *G. Alves-Silva* 1283 (ICN).

Fomitiporia pulvinata ad int. Alves-Silva, R.M. Silveira & Drechsler-Santos, **sp. nov.**

FIGS. 1, 6

MycoBank (to be provided)

Typification: BRAZIL, Paraná: Campo Mourão, Parque Estadual do Lago Azul, 24°06'15.2"S 52°18'30.1"W, on dead trunk, 25 Feb 2017, *G. Aves-Silva* 1073 (ICN).

Etymology: pulvinata ad int., from *pulvinatus* (Latin) = cushion-shaped; in reference to *Fomitiporia* species with cushion-shaped basidioma.

Description: Basidioma perennial, resupinate, broadly attached, adnate, well delimited, ellipsoid, cushion-shaped, 24–61 mm long, 15–36 mm wide and 3–12 mm thick, dense, with woody consistency. Margin round, folded, sterile, first pale yellow to light yellow [4A(3–5)], golden yellow (5B7) to brownish yellow [5C(7–8)] or yellowish brown [5D(6–8)], narrow when below or above of the substrate, when oblique, up to 8 mm long, brownish orange [7C(6–8)] becoming black. Pore surface greyish brown, brownish beige (6E3) to cinnamon when older; pores round to angular, 7–9/mm, (137–)141–197(–205) µm diam. (ave = 170 µm); dissepiments entire, (71–)76–186(–196) µm (ave = 123 µm) thick. Tubes mostly indistinctly stratified, light brown to brownish orange [6CD(6–8)], youngest (active) layer greyish brown (6E4) to cinnamon, older layers filled with whitish mycelium. Subiculum reduced to a thin layer next to the substrate, concolorous with the tube layers.

Hyphal system dimitic in all parts; generative hyphae simple-septate, hyaline to pale yellow, sparingly branched, 2.3–2.8 µm diam; skeletal hyphae golden brown to reddish brown, unbranched, thick-walled, occasionally with local swellings (5–9 µm diam), 2.5–3.5(–4) µm diam, the lumen 0.8–2 µm wide in the subiculum and hymenophoral trama.

Hymenial setae absent. Cystidioles rare, fusoid, lanceolate, hyaline, thin-walled. Basidia subglobose to globose, hyaline, tetrasporic, 8–9.5(–10) × 7.5–8.5 µm (ave = 8.5 × 8 µm), Q = 1–1.2 µm (Qm = 1.06 µm); basidioles identical in shape but slightly smaller than basidia. Basidiospores subglobose to globose, (4–)4.5–6 × 4–5.5 µm (ave = 5.1 × 4.8 µm), Q = 1–1.2 µm (Qm = 1.07 µm), hyaline, slightly to moderately dextrinoid and cyanophilous, thick-walled, smooth. Crystals rhomboid, of variable size.

Physiology, substrate, habitat, and known distribution: white-rot fungus, dead unidentified angiosperm, Brazil in Araucaria Forest Province in Paraná state.

Comments: Fomitiporia pulvinata ad int. is mostly characterized by having perennial, resupinate, cushion-shaped and well delimited basidiomata and 3–12 mm thick. Microscopically, it has slightly to moderately dextrinoid basidiospores, 5.1 × 4.8 µm on average. In the phylogeny, *F. pulvinata* ad int. was recovered in the *F. langloisii*–*F. castilloi* clade, sister lineage of *F. sonorae*+*F. langloisii*+*F. ignea*+*F. maxonii*. Regarding the species of this clade, *F. pulvinata* ad int. is morphologically closely related to *F. chilensis, F. dryophila*, *F. impercepta*, and *F. langloisii,* which all share cushion-shaped basidiomata. However, *F. pulvinata* ad int. differs mainly by having smallest basidiospores on average and it is unique never measuring 7 µm long. In addition, *F. chilensis* has larger pores [(4–)6–7.5) vs. 7–9 p/mm]; *F. dryophila* is characterized mainly by having pseudopileate basidioma, and *F. impercepta* and *F. langloisii* have effused basidiomata (Decock et al. 2007; Morera et al. 2017; Rajchenberg et al. 2019), whereas *F. pulvinata* ad int. has well delimited and ellipsoid basidiomata

Fomitiporia maxonii Murrill, N. Amer. Fl. (New York) 9(1): 11 (1907)

MycoBank: MB372887

≡*Phellinus maxonii* (Murrill) D.A. Reid, Kew Bull. 35:867, 1981.

=*Fomitiporia jamaicensis* Murrill, North American Flora 9, part I:11, 1907.

=*Fuscoporella costaricencis* Murrill, North American Flora 9:7, 1907.

=*Fomes platincola* Speg., Bol Acad Nac Cienc Córdoba 28:358, 1926.

Description: See Decock et al. (2007).

Physiology, substrate, habitat, and known distribution: white-rot fungus, dead tree branches, trunks, and stumps with wide range of hosts, both native and exotic ones, widely distributed in Neotropics.

Comments: Fomitiporia maxonii is mainly characterized by having perennial, broadly effused, resupinate basidiomata, 7–9(–10) pores/mm. Microscopically, basidiospores are strongly dextrinoid, 6 × 5.5 µm on average. In the phylogeny, it has been placed nested within *F. langloisii*–*F. castilloi* clade and sister to *F. ignea*. Considering co-occurrent and morphologically related species, *F. expansa* and *F. neotropica* differ by having longer (*F. expansa*: >100 cm; *F. neotropica*: up to 30 cm vs. 13 cm long) and thinner basidiomata (both: 1.5–5 mm vs. 3–10 mm thick). Also, *F. neotropica* has one or two tube layers, slightly smaller basidiospores [5–7(–7.5) vs. (4.5–)5.3–6.5(–7) µm], and occasionally presents straight hymenial setae, whereas *F. maxonii* can be multi-layered, presents basidiospores with length up to 7 µm, and lacking hymenial setae (Amalfi and Decock 2014; Campos-Santana et al. 2014). *Fomitiporia impercepta* differs by having larger pores [(5–7 vs. 7–9(–10) pores/mm] (Morera et al. 2017) and *F. langloisii* shares an effused, up to 14 cm long basidiomata, nevertheless differs by having slightly bigger pores [(6–)7–8(–9) vs. 7–9(–10) pores/mm], thicker and mostly cushion-shaped basidiomata and an USA-continental distribution (Decock et al. 2007).

From critically revision of *F. maxonii*, Decock et al. (2007) confirmed this species is not conspecific to *F. punctata* (Eurasian distribution) and neither *F. langloisii* and *F. dryophila* (USA). Besides, they suggested a restricted distribution to Neotropics and widespread, from Cuba to Argentina. Even though *F. maxonii* has been previously reported from Brazil (Baltazar and Gibertoni 2009; Drechsler-Santos et al. 2010; Abrahão et al. 2012; Motato-Vásquez and de Mello Gugliotta 2014), in this study, for the first time, molecular data is available and we confirmed this occurrence with an Amazon specimen (SUPPLEMENTARY FIGURE 1).

Specimens examined: BRAZIL, Amazonas: Manaus, Praça da saudade, on dead branches of living unidentified angiosperm, 13 Jul 2017, *G. Alves-Silva* 1178 (INPA278267); COSTA RICA, vicinity of Santo Domingo de San Mateo, alt. 300 m.a.s.l., on rotten log, 15–17 May 1906, *W.R. Maxon* 587 (*F. maxonii* **holotype:** NY776489);

Additional specimens examined: JAMAICA, on grapefruit (*Citrus X paradisi*), *F. S. Earle 215*, (**holotype** of *F. jamaicensis*: NY776486); USA, Louisiana: near St Martinsville, on decaying pieces of deciduous wood, in low woods, 12 Nov 1897, *A.B. Langlois* 2525 (*F. langloisii* **holotype**: NY776501); ibid., Mississippi: Back Bay, edge of salt marsh, on a decayed live-oak stump, 3 Sep 1904, *E.S.E. Earle* 25, (**holotype** of *F. dryophila*: NY776475).

Fomitiporia elliptica ad int. Alves-Silva & Drechsler-Santos, **sp. nov.** FIGS. 1, 7

MycoBank (to be provided)

Typification: BRAZIL, Santa Catarina: Florianópolis, Parque Municipal Córrego Grande, 27°35'50"S 48°30'34.7"W, on dead standing tree (*Melia azedarach*), 25 Apr 2015, *E.R. Drechsler-Santos* 1737 (ICN).

Etymology: elliptica ad int., from *ellipticus* = elliptic, elliptical; in reference to elliptic basidiomata.

Description: Basidiomata perennial, resupinate, adnate, elliptic, cushion-shaped to pseudopileate, well-delimited, up to 200 mm long, 85 mm wide, to 25 mm thick, with woody consistency. Margin round, first greyish to yellowish orange [4B(7–8)], becoming brownish yellow [5C(7–8)], brownish orange [5C(5–6)] and turning brown [5DE(5–8)], ferruginous brown, to black, surface as a hard and dark crust, cracked with age; in vertical substrate specimens, the accumulation of tubes layers at the upper margin and subsequent surface indurations form a pseudopileus. Pore surface greyish brown, brownish beige [5E(2–3)] to cinnamon when older, slightly iridescent; pores round to angular, slightly elongated on oblique part, (4–)5–9/mm, (97–)103–285(–312) µm diam. (ave = 189 µm); dissepiments entire, (121–)128–332(–357) µm (ave = 202 µm) thick. Tubes mostly indistinctly stratified, with thin context among layers, light brown to golden brown [5D(5–8)], older layers filled with whitish mycelium. Subiculum thin, up to 2 mm, brownish orange [6C(6–8)] to black near to substrate.

Hyphal system dimitic in all parts; generative hyphae simple septate, hyaline to pale yellow, sparingly branched, 2–3 µm diam.; skeletal hyphae golden brown to reddish brown, unbranched, thick-walled, in the context 2.5–3.5(–4) µm diam., the lumen 1–2 µm wide and hymenophoral trama (2–)2.5–3.5(–4.5) µm diam., the lumen 1–2(–2.5) µm wide. Hymenial setae absent. Cystidioles rare, fusoid, lanceolate, hyaline, thin-walled. Basidia subglobose to globose, hyaline, tetrasporic, 8–9 × 7–8.5 µm (ave = 8.9 × 7.8 µm), Q = 1–1.3 µm (Qm = 1.2 µm); basidioles identical in shape but slightly smaller than basidia. Basidiospores subglobose to globose, (4–)4.5–6(–7) × 4–6(–6.5) µm (ave = 5.5× 5.1 µm), Q = 1–1.2(–1.5) µm (Qm = 1.2 µm), hyaline, moderately to mostly strongly dextrinoid and cyanophilous, thick-walled, smooth. Crystals rhomboid, of variable size.

Physiology, substrate, habitat, and known distribution: white-rot fungus, dead unidentified angiosperm, Brazil in Atlantic Province in Bahia and Santa Catarina states and Xingu-Tapajós Province in Mato Grosso state.

Comments: Fomitiporia elliptica ad int. is mainly characterized by having perennial, resupinate, well-delimited, elliptic, cushion-shaped to pseudopileate basidiomata and round margin. Microscopically, basidiospores are moderately to strongly dextrinoid, 5.5× 5.1 µm on average. In phylogeny, this species was recovered nested within clade of Neotropical resupinate species, sister to *F. dryophila*–*F. langloisii* clade. Regarding Neotropical resupinate species, *F. elliptica* ad int. is closely morphologically related to *F. biformis* ad int., *F. chilensis, F. dryophila, F. langloisii*, and *F. pulvinata* ad int., which they share any or all of follow characteristics: thick, cushion-shaped to pseudopileate basidiomata. *Fomitiporia biformis* ad int. differs by having slightly bigger pores [(5–)6–7(–8) vs. (4–)5–9 pores/mm] and thinner basidiomata (up to 16 mm vs. up to 25 mm thick), in addition, when on vertical substrate, tube layers accumulation develops real pilei, whereas *F. elliptica* ad int. has darker pseudopileus surface due to age, with no concentric zonation (FIG. 7B). *Fomitiporia chilensis* differs by having bigger pores (6–7.5 vs. 5–9 pores/mm) and bigger basidiospores (6.4 × 5.8 vs. 5.5 × 5.1 µm on average), moreover thicker basidiomata (5–70 mm thick). *Fomitiporia dryophila* and *F. langloisii* differ by having bigger basidiospores (*F. dryophila*:

7 × 6.5 and *F. langloisii*: 6 × 5.5 vs. 5.5 × 5.1 µm on average) and continental-USA distribution. Finally, *F. pulvinata* ad int. differs by having slightly smaller basidiospores [(4–)4.5–6 × 4–5.5 vs. (4–)4.5–6(–7) × 4–6(–6.5)], never reaching 7 µm long, thinner basidiomata (3–12 mm vs. up to 25 mm thick), no longer than 61 mm (vs. up to 200 mm long).

Additional specimens examined: BRAZIL, Bahia: Igrapiúna, Reserva Ecológica da Michelin, 13°50'59.8"S 39°13'44.3"W, 300 m.a.s.l., on dead standing unidentified angiosperm, 21 Sep 2016, *G. Alves-Silva* 923 (ICN); ibid., Mato Grosso: Novo Mundo, Parque Estadual Cristalino, parcelas PPBio, 9°30'49.04” S, 55°39'25.75" W, on dead branch, 11 Mar 2015, *D. Batistella* 3-31 (FLOR 58567).

Fomitiporia rondoni ad int. Alves-Silva & Drechsler-Santos, **sp. nov.** FIGS. 1, 8

MycoBank (to be provided)

Typification: BRAZIL, Mato Grosso: Cuiabá, Parque Nacional de Chapada dos Guimarães, Sítio Véu de Noiva, 15°24'23.19"S 55°50'12.14"W, on dead trunk, unidentified angiosperm, 8 Feb 2015, *G. Alves-Silva* 726 (FLOR 58557).

Etymology: rondoni ad int., named in honor of Marechal Cândido Rondon, due to his scientific-cultural contribution to the region of occurrence of the species, through expeditions in 1900–1930.

Description: Basidiomata perennial, pileate, sessile, semicircular, obtriquetrous to triquetrous, occasionally concave, projecting 42–115 mm, 41–160 mm wide and 25–85 mm thick at the base, with a woody consistency. Pileus glabrous, concentrically zonate with multiple narrow bands and up to 6 broad bands, moderately sulcate, faintly to strongly cracked, dull, dark brown [7F(4–8)] to black, greenish by algae and greyish to whitish in older basidiomata. Margin round, folded, thick, sterile, light orange [5A(5–6)] to golden brown, light brown, yellowish brown [5D(6–8)]. Pore surface greyish brown, brownish grey [7F(2–3)], dark brown [7F(4–5)] to cinnamon; pores round to angular, (5–)6–9(–10)/mm, (122–)127–155(–168) µm diam. (ave = 141.46 µm); dissepiments entire, (59–)67–223(–238) µm (ave = 102 µm) thick. Tubes distinct to mostly indistinctly stratified, with several layers, interleaved with context in older tube layers, brown [5EF(4–5)] to grayish brown (5E3), the older layers filled with whitish mycelium. Context simple, up to 10 mm thick, concentrically zonate, with dense texture and with a woody consistency, brownish orange [6C(7–8)], light brown to brown [6DE(7–8)], with a distinct thick dark line near to surface.

Hyphal system dimitic in all parts; generative hyphae simple septate, hyaline to pale yellow, sparingly branched, 1.5–2.5 µm diam.; skeletal hyphae golden brown to reddish brown, unbranched, thick-walled, in the context and hymenophoral trama 3–4.5 µm diam., the lumen 0.8–2.5(–2.8) µm wide. Hymenial setae absent. Cystidioles rare, fusoid, lanceolate, hyaline, thin-walled. Basidia subglobose to globose, hyaline, tetrasporic, 8–9(–10) × 7–8 µm (ave = 8.5 × 7.3 µm), Q = 1–1.4 µm (aveQ = 1.18 µm); basidioles identical in shape but slightly smaller than basidia. Basidiospores subglobose to globose, (4–)5–6 × (4–)4.5–5(–6) µm (ave = 5 × 4.8 µm), Q = 1–1.1 µm (aveQ = 1.2 µm), hyaline, moderately to strongly dextrinoid, cyanophilous, thick-walled, smooth. Crystals rhomboid, of variable size.

Physiology, substrate, habitat, and known distribution: white-rot fungus, dead unidentified angiosperm, Brazil in Cerrado and Xingu-Tapajós Provinces in Mato Grosso state.

Comments: *Fomitiporia rondoni* ad int. is characterized mainly by having obtriquetrous basidiomata, mostly indistinctly stratified tube layers, and greyish to whitish pileus in older basidiomata. Microscopically, basidiospores are moderately to strongly dextrinoid, 5 × 4.8 µm on average. Phylogenetically, this species was recovered in *F. langloisii*–*F. castilloi* clade, in which only *F. castilloi*, *F. bambusipileata*, and an undescribed species proposed below are pileate. *Fomitiporia castilloi* differs by having hymenial setae and *F. bambusipileata* occurs on bamboos culm (Amalfi and Decock 2013; Alves-Silva et al. 2020a). Concerning the remaining Neotropical pileate species, *F. rondoni* ad int. is morphologically closely related to *F. apiahyna* s.lat and other Neotropical pileated species discussed below. *Fomitiporia atlantica, F. prolongata* ad int., and *F. subtilissima* have distinctly basidiomata development (see above); *F. nubicola* and *F. apiahyna* differ by having particular ecological requirements, the former occurs exclusively on *Drimys* spp. in Cloud forests and the latter in Araucaria Forest province, at 800–1,000 m.a.s.l. (Alves-Silva et al. 2020b), whereas *F. rondoni* ad int. appears to be restricted to Cerrado–Amazon distribution; *F. elegans* and *F. puiggarii* ad int. differ by having mostly applanate, smaller, and thinner basidiomata (*F. elegans*: 8–21 mm and *F. puiggarii* ad int.: 19–21 mm thick vs. 25–85 mm thick) (Alves-Silva et al. 2020b); *F. melanoderma* ad int. by having hard and dark abhymenial surface; *F. conyana* and *F. murrilli* by having slightly bigger pores [*F. conyana*: 6–8(–9)/mm and *F. murrilli*: (4–)5–7(–8)/mm vs. (5–)6–9(–10)/mm], moreover *F. murrilli* also has slightly bigger basidiospores, 5–6(–7) × 5–6(–7) µm vs. (4–)5–6 × (4–)4.5–5(–6) µm (Alves-Silva et al. 2020b).

Additional specimens examined: BRAZIL, Mato Grosso: Itaúba, Rio Teles Pires, 11°03'54.2"S 55°19'25.2"W, on dead standing unidentified angiosperm, 01 Apr 2017, *M. E. Engels* (ICN).

Fomitiporia exigua ad int. Alves-Silva, Reck & Drechsler-Santos, **sp. nov.** FIGS. 1, 9

MycoBank (to be provided)

Typification: BRAZIL, Amazonas: Novo Airão, Parque Nacional Anavilhanas, Igarapé Santo Antônio, 2°24'42.5"S 60°58'08.9"W, on living tree (*Protium heptaphyllum* (Aubl.) Marchand), 6 Dec 2013, *E.R. Drechsler-Santos* 1256 (FLOR 58558).

Etymology: exigua ad int., from *exiguus* (Latin) = little, small in all parts; in reference to small basidiomata species.

Description: Basidiomata perennial, pileate, sessile and mostly broadly attached, subdimidiate, semicircular symmetric to asymmetric, spatulate, applanate to convex (in older basidiomata), obtriquetrous to rarely triquetrous, projecting 2–18.5 mm, 4–13 mm wide and 2–8 mm thick, with woody consistency when dried. Pileus glabrous, concentrically zonate with multiple narrow bands, moderately sulcate, brown, dark brown [6EF(6–8)] to black; margin acute, folded, well delimited around pore surface, sterile, light brown, yellowish brown to brown [5DE(5–8)]. Pore surface light greyish brown (5D8) to greyish brown (6F3), (8F3); pores round to angular, 8–12/mm, (60–)70–120 µm diam. (ave = 84 µm); dissepiments entire, 20–90 µm (ave = 51.4 µm) thick. Tubes distinct stratified, up to 6 layers interleaved with context, individual tube layers thin, up to 0.5 mm thick, brown [5EF(3–4)] to grayish brown (5F3), the older layers filled with whitish mycelium. Context simple, thin, concentrically zonate, with dense texture and woody consistency, brown to dark brown [6EF(6–8)], with a distinct dark line near to surface.

Hyphal system dimitic in all parts; generative hyphae simple septate, hyaline to pale yellow, sparingly branched, 2–2.5 µm diam.; skeletal hyphae golden brown to reddish brown, unbranched, thick-walled, in the context and hymenophoral trama 3–4 µm diam., the lumen 1–2 µm wide. Hymenial setae absent. Cystidioles rare, fusoid, lanceolate, hyaline, thin-walled. Basidia subglobose to globose, hyaline, tetrasporic, 7–9 × 6–8 µm (ave = 7.7 × 6.9 µm), Q = 1–1.3 µm (aveQ = 1.12 µm); basidioles identical in shape but slightly smaller than basidia. Basidiospores subglobose to globose, 4–4.5 × 4–4.5 µm (ave = 4.2 × 4.1 µm), Q = 1.0–1.3 µm (aveQ = 1.02 µm), hyaline, undextrinoid to slightly dextrinoid, cyanophilous, thick-walled, smooth. Crystals rhomboid, of variable size.

Physiology, substrate, habitat, and known distribution: white-rot fungus, on living tree (*Protium heptaphyllum*), Brazil in Imerí Province, Amazonas state.

Comments: *Fomitiporia exigua* ad int. is mainly characterized by having perennial, small (less than 20 mm long and wide) and thin (less than 10 mm thick) basidiomata; convex pileus in the older basidiomata; and small pores (8–12/mm). Microscopically, it has small basidiospores, 4.2 × 4.1 µm on average and variable reaction in Melzer, from undextrinoid to slightly dextrinoid (FIG. 9F–G). Phylogenetically, it was recovered in *F. langloisii*–*F. castilloi* clade, sister to *F. rondoni* ad int.. As *F. rondoni* ad int., it has pileate basidiomata, which is different from most of species of this clade. *Fomitiporia rondoni* ad int. differs by having bigger basidiomata and basidiospores (5 × 4.8 vs. 4.2 × 4.1 µm). In addition, *F. exigua* ad int. differs of all pileate species by having the smallest basidiomata in the genus and undextrinoid to slightly dextrinoid basidiospores.

Fomitiporia neotropica Camp.-Sant., Amalfi, R.M. Silveira, Robledo & Decock, Mycol. Progr. 13(3): 610 (2014)

MycoBank: MB805940

Description: See Campos-Santana et al. (2014).

Physiology, substrate, habitat, and known distribution: white-rot fungus, dead tree branches, trunks, and stumps with wide range of hosts, both native and exotic ones widely distributed in Neotropics.

Comments: Fomitiporia neotropica is mainly characterized by having resupinate, thin, and effused basidiomata, up to two tube layers, and small pores (5–)6–9(–12)/mm. Microscopically, basidiospores are strongly dextrinoid, 5–7(−7.5) × 4.5–7 μm and hymenial setae are variably present. In the phylogeny, it has been placed nested within *F. langloisii*–*F. castilloi* clade and sister to *F. chilensis* and *F. impercepta*. In comparison to resupinate species with hymenial setae, bambusicolous *Fomitiporia* species occur on bamboos, *F. ignea* occurs on *Vitis vinifera* and has longer hymenial setae as well as *F. sonorae* (*F. ignea*: 10–55 μm and *F. sonorae*: 35–55 μm vs. *F. neotropica*: 10–30 μm long) (Gilbertson 1979; Brown et al. 2019; Alves-Silva et al. 2020a). *Fomitiporia neotropica* is morphologically closely related to *F. biformis* ad int., *F. elliptica* ad int., *F. expansa*, *F. impercepta*, *F. langloisii*, and *F. maxonii*, sharing at least in initial development stage of basidiomata, an effused and short to long basidiomata. For morphological comparisons with *F. biformis* ad int., *F. elliptica* ad int., and *F. maxonii* see above and with *F. impercepta* see below. *Fomitiporia expansa* differs by having mostly longer basidiomata (>100 cm vs. up to 30 cm long) and slightly smaller basidiospores (5.5–6.3(–6.6) × 5–5.7 μm vs. 5–7(−7.5) × 4.5–7 μm) while *F. langloisii* by having thicker (2–18 mm vs. 1.5–5 mm thick) and effused to cushion-shaped basidioma and continental-USA distribution as well (Decock et al. 2007; Amalfi and Decock 2014). In this study we increased geographic distribution of *F. neotropica* in Brazil, which it appears to be common. These data reinforce its Neotropical widespread distribution as presumed (Campos-Santana et al. 2014).

Specimens examined: See SUPPLEMENTARY DATA 01.

Fomitiporia impercepta Morera, Robledo & Urcelay, Phytotaxa 321(3): 281 (2017)

MycoBank: MB817799

Description: See Morera et al. (2017).

Physiology, substrate, habitat, and known distribution: white-rot fungus, dead tree branches, trunks, and stumps with wide range of hosts, both native and exotic ones, widely distributed in Neotropics.

Comments: Fomitiporia impercepta is mainly characterized by having perennial, resupinate, short (up to 60 mm long), thick (2–10 mm thick), and cushion-shaped basidiomata with 5–7 pores/mm. Microscopically, basidiospores are strongly dextrinoid, (4–)5–6(–7) × 4–6(–7) μm. Phylogenetically, this species has been recovered nested within *F. langloisii–F. castilloi* clade and sister to *F. chilensis* and *F. neotropica*. Even though *F. impercepta* has mostly cushion-shaped basidiomata, it could be comparable also with commonly effused ones. For morphological comparisons with *F. biformis* ad int., *F. elliptica* ad int., *F. maxonii*, and *F. pulvinata* ad int. see above. From species with mostly effused basidiomata, *F. expansa* differs by having mostly longer (>100 cm vs. up to 6 cm long) and thinner (1.5–5 mm vs. 2–10 mm thick) basidiomata and *F. neotropica* by having thinner basidiomata (1.5–5 mm vs. 2–10 mm thick), smaller pores [(5–)6–9(–12)/mm vs. 5–7/mm], and slightly bigger basidiospores [5–7(−7.5) × 4.5–7 µm vs. (4–)5–6(−7) × 4–6(–7) µm] (Amalfi and Decock 2014; Campos-Santana et al. 2014). Regarding species with cushion-shaped to pseudopileate basidiomata, *F. langloisii* and *F. dryophila* differ by having thicker basidiomata and bigger basidiospores, as well as continental-USA distributions, while *F. chilensis* presents usually thicker basidiomata (5–70 mm vs. 2–10 mm thick) and bigger basidiospores (6.4 × 5.8 µm vs. 5.6 × 5.1 µm on average) (Decock et al. 2007; Rajchenberg et al. 2019). Also, *F. impercepta* has been described from Argentina and French Guiana specimens, with presumed distribution in South America (Morera et al. 2017). This is the first record of species in Brazil.

Specimens examined: See SUPPLEMENTARY DATA 02.

Fomitiporia castilloi Decock & Amalfi, Mycologia 105(4): 880 (2013)

MycoBank: MB563792

Description: See Amalfi and Decock (2013).

Physiology, substrate, habitat, and known distribution: white-rot fungus, dead unidentified angiosperms, Guianan Lowlands Province in French Guiana and Roraima Province in Amazonas state, Brazil.

Comments: *Fomitiporia castilloi* is mainly characterized by having perennial, pileate basidiomata and pileus with broad bands. Microscopically, it has abundant, straight to sinuous hymenial setae, 30 × 7.9 µm on average. *Fomitiporia castilloi* has been recovered sister to clade of mostly resupinate species, the so-called *F. langloisii*–*F. castilloi* clade. From pileate species with hymenial setae, *F. texana* differs by having cracked pileus and bigger basidiospores (BPI892681: 7.8 × 7.0 vs. 6.2 × 5.2 µm). The geographic distribution of *F. castilloi* was restricted to type location (Amalfi and Decock 2013), however, in this study, from an old collection of Amazonas state, we reported the first record for Brazil.

Specimens examined: BRAZIL, Amazonas: Itacoatiara, Itacoatiara highway, Rio Urubú, Km 206, approx. 3°01'42.8"S 58°34'13.4"W, 21 Dec 1966, *G.T. Prance* (INPA19425); FRENCH GUIANA, Regina: Nouragues Natural Reserve, 04º05.59’N 52º40.69’W, on a dead standing trunk, 06 Aug 2010, *C. Decock*, FG-10-282 (**isotype:** NY01840468).

Fomitiporia rhizophila ad int. Alves-Silva, R.M. Silveira & Drechsler-Santos, **sp. nov.**

FIGS. 1, 10

MycoBank (to be provided)

Typification: BRAZIL, Paraná: Campo Mourão, Parque Estadual do Lago Azul, 24°06'15.2"S 52°18'30.1"W, at the base and roots of living unidentified angiosperm; surrounded by *Merostachys multiramea* in a predominant bamboo path, 25 Feb 2017, *G. Aves-Silva* 1071 (ICN).

Etymology: rhizi- (Greek) = pertaining to roots + -philus (Greek) = closely related, “friend”; it means species living on roots.

Description: Basidiomata perennial, pileate; multiple interconnected pilei to rarely sessile; reniform, semicircular, nodulose, triquetrous, obtriquetrous, projection first upward, projecting 5.5–85 mm, 9–89 mm wide and 8–42 mm thick, with woody consistency. Pileus glabrous, concentrically zonate with broad bands (up to 3), irregularly and strongly sulcate, slightly cracked with age and on drying, light brown [5D(5–8)] to brown [5E(5–8)] becoming dark brown [6F(5–8)] to black, with narrow concentric black lines in the younger layer; margin round, folded, sterile, rarely attached to older pileus, pale yellow to light yellow [4A(3–5)] in young specimens, golden yellow (5B7) to brownish yellow [5C(7–8)] or yellowish brown [5D(6–8)]. Pore surface greyish brown, brownish beige (6E3) to cinnamon when older; pores round, angular to oblique, (4–)5–7(–8)/mm, (190–)200–302(–327) µm diam. (ave = 255.4 µm); dissepiments entire, (99–)117–228(–291) µm (ave = 166.7 µm) thick. Tubes indistinctly stratified, light brown to brown [6DE(6–8)], in young (active) layer greyish brown (6E4) to cinnamon, older layers filled with whitish mycelium. Context simple, up to 8 mm thick, with dense texture and woody consistency, brownish orange to reddish golden, [6BC(7–8)].

Hyphal system dimitic in all parts; generative hyphae simple-septate, hyaline to pale yellow, sparingly branched, 2.7–3.7 µm diam; skeletal hyphae golden brown to reddish brown, unbranched, thick-walled, occasionally with local swellings (5.6–10 µm diam), (2.7–)3–4.4 µm diam, the lumen 1.2–2.6 µm wide in the context and hymenophoral trama. Hymenial setae absent. Cystidioles rare, fusoid, lanceolate, hyaline, thin-walled. Basidia subglobose to globose, hyaline, tetrasporic, 10–13 × 8–9 µm (ave = 11.2 × 7.9 µm), Q = 1.3–1.6 µm (Qm = 1.4 µm); basidioles identical in shape but slightly smaller than basidia. Basidiospores subglobose to globose, 5–6.5 × 4–5.5 µm (ave = 5.6 × 4.75 µm), Q = 1.05–1.22(–1.5) µm (Qm = 1.18 µm), hyaline, slightly dextrinoid, strongly cyanophilous, thick-walled, smooth. Crystals rhomboid, of variable size.

Physiology, substrate, habitat, and known distribution: white-rot fungus, roots of living unidentified angiosperm, surrounded by *Merostachys multiramea* in a bamboo monodominant path, Brazil in Araucaria Forest Province in Paraná state.

Comments: *Fomitiporia rhizophila* ad int. is mostly characterized by having perennial, nodulose and reniform basidiomata, multiple interconnected pilei, upward projection (FIG. 10B), and pileus concentrically zonate with mostly broad bands, strongly and irregularly sulcate. Microscopically, it has slightly dextrinoid basidiospores, 5.6 × 4.75 µm on average. *Fomitiporia rhizophila* ad int. was recovered nested within *F. texana* clade, which is composed by two another undescribed species. From this clade, *F. texana* differs by having cracked pileus, bigger basidiospores (BPI892681: 7.8 × 7 µm vs. 5.6 × 4.75 µm on average), and hymenial setae. In addition, *F. rhizophila* ad int. differs of overall Neotropical pileate species by having nodulose basidiomata, multiple interconnected pilei, and upward projection

Additional specimen examined: BRAZIL, Paraná: Campo Mourão, Parque Estadual do Lago Azul, 24°06'15.2"S 52°18'30.1"W, on roots of standing dead unidentified angiosperm; surrounded by *Merostachys multiramea* in a predominant bamboo path, 25 Feb 2017, *G. Aves-Silva* 1072 (ICN).

Key to Neotropical *Fomitiporia* species

1 Hymenial setae present 2
1* Hymenial setae absent.. 11
2(1) Bamboo host.. 3
2* Other hosts 7
3(2) Pileate basidiomata.. **F. bambusipileata**
3* Resupinate basidiomata 4
4(3) Uncinate hymenial setae..***F. uncinata***

4* Straight hymenial setae. 5

5(4) Hymenial setae with scattered spines in the subapex............................***F. spinescens***

5* Smooth hymenial setae. 6

6(5) Scattered hymenial setae (12–40 µm long); basidiospores 5.7 × 5.3 µm on average . ...***F. sanctichampagnatii***

6* Abundant hymenial setae (13–21 µm long); basidiospores 4.9 × 4.6 µm on average ... .***F. bambusarum***

7(2) Pileate basidiomata... 8

7* Resupinate basidiomata. 9

8(7) Basidiospores 6.5–9 µm wide .... ***F. texana***

8* Basidiospores 5–5.5 µm wide. ....***F. castilloi***

9(7) Hymenial setae <30 µm long ....***F. neotropica***

9* Hymenial setae usually >30 µm long.. 10

10(9) Pores 5–7/mm; basidiospores 5–5.5 µm long .... ***F. sonorae***

10* Pores 8–10/mm; basidiospores 4–8 µm long.. ***F. ignea***

11(1) Pileate basidiomata... 12

11* Resupinate basidiomata 27

12(11) Basidiomata found in Andean high altitudes 13

12* Basidiomata found outside of Andean high altitudes 14

13(12) Cushion-shaped to pseudopileate basidiomata; growing on *Polylepis* spp. ....***F. tabaquilio***

13* Pileate to occasionally effused-reflexed basidiomata; growing on several hosts, e.g. *Baccharis oblongifolia*... ***F. baccharidis***

14(12) Basidiospores 4–5 µm long, length never reaching 6 µm 15

14* Basidiospores 4–7 µm long... 16

15(14) Basidiomata with up to 13 mm wide; 8–12 pores/mm; basidiospores undextrinoid to slightly dextrinoid, 4.2 × 4.1 µm on average .... ***F. exigua*** ad int.

15* Applanate and thin basidiomata, up to 40 mm wide; (4–)5–9 pores/mm; slightly to moderately dextrinoid basidiospores, 4.5 × 4 µm on average ....***F. subtilissima***

16(14) Basidiospores mostly 6–7 µm long; (6–)7–9(–10) pores/mm, up to 150 µm diam . ...***F. elegans***

16* Basidiospores, rarely reaching 7 µm long, mostly 5–6 µm long; (3–)4–9(–10) pores/mm, (50)80–300(–385) µm diam. 17

17(16) Growing on roots; nodulose pileus...***F. rhizophila*** ad int.

17* Growing on fallen and/or standing trunks or stumps; concentrically zonate pileus 18

18(17) Basidiospores with mostly 5–6(–7) µm long and (4–)5–6(–7) µm wide 19

18* Basidiospores with mostly (4.5–)5–6 µm long and (4–)4.5–5.5(–6) µm wide........ 22

19(18) Pileate to pseudopileate basidiomata, rarely ungulate, broadly attached, effused .. ..***F. biformis*** ad int.

19* Pileate, triquetrous, obtriquetrous basidiomata... 20

20(19) Basidiomata growing on *Drimys* sp., in Cloud forests.........................***F. nubicola***

20* Basidiomata growing on other hosts, outside of Cloud forests 21

21(20) Basidiomata growing mostly on Lauraceae (e.g. *Ocotea* sp.), in Araucaria Forest Province, 800–1,000 m.a.s.l. ....***F. apiahyna***

21* Basidiomata growing mostly on Myrtaceae (e.g. *Eucalyptus* sp.), commonly in anthropized vegetation ....***F. murrilli***

22(18) Nodulose to imbricate basidiomata, broadly attached; mostly olivaceous brown pileus .... ***F. atlantica***

22* Triquetrous, obtriquetrous basidiomata; brown, dark brown to black pileus 23

23(22) Basidiomata with successive deposition of tube layers forward, which does not cover near the base the precedent layer .... ***F. prolongata*** ad int.

23* Basidiomata with downward tube layers deposition, in which each precedent layer is fully covered 24

24(23) Abhymenial surface with black crust .... ***F. melanoderma*** ad int.

24* Abhymenial surface with brown, dark brown to black crust 25

25(24) Basidiomata growing in southern Brazil, in Atlantic and Parana Forest (subtropical) Provinces; pores occasionally lacerate, 3–5/mm (mostly range: 4–8/mm) .... ***F. puiggarii*** ad int.

25* Basidiomata growing mostly in tropical latitudes; (5–)6–9(–10) pores/mm 26

26(25) Whitish to greyish abhymenial surface; (5–)6–9(–10) pores/mm, maximum 168 µm diam.; central Brazil .... ***F. rondoni*** ad int.

26* Brown, dark brown to black abhymenial surface; 6–8(–9) pores/mm, up to 240 µm diam.; widely distributed .... ***F. conyana***

27(11) Basidiospores (5.5–)6–8(–8.5) µm long... ***F. dryophila***

27* Basidiospores (4–)5–7(–7.5) µm long 28

28(27) Basidiomata bi-sazonal to perennial, maximum 5 mm thick, effused 29

28* Basidiomata perennial, thicker, cushion-shaped to pseudopileate........................... 30

29(28) Basidiomata extending up to > 100 cm long; basidiospores 5.5–6.3(–6.6) × 5–5.7 µm .... ***F. expansa***

29* Basidiomata extending up to 30 cm long; basidiospores 5–7(–7.5) × 4.5–7 µm.. ***F. neotropica***

30(28) Basidiospores rarely 6 µm long, slightly to moderately dextrinoid.. ***F. pulvinata*** ad int.

30* Basidiospores up to 7 µm long, moderately to strongly dextrinoid......................... 31

31(30) Basidiomata effused, extending 13–50 cm 32

31* Basidiomata well delimited, mostly cushion-shaped to pseudopileate................... 34

32(31) Basidiospores, 5.3 × 5 µm on average, moderately to strongly dextrinoid; (5–)6–7(–9) pores/mm.. ***F. biformis*** ad int.

32* Basidiospores, 6 × 5.5 µm on average, strongly dextrinoid; (6–)7–9(–10) pores/mm33

33(32) Basidiomata broadly effused; 7–9(–10) pores/mm; growing mostly in Central and South America .... ***F. maxonii***

33* Basidiomata effused to cushion-shaped; (6–)7–8(–9) pores/mm; growing mostly in continental USA.. ***F. langloisii***

34(31) Pores (4–)6–7.5/mm; basidiospores 6–6.8 × 5.4–6.2 µm, 6.4 × 5.8 µm on average .... ***F. chilensis***

34* Pores (4–)5–9/mm; basidiospores, (4–)4.5–6(–7) × (4–)4–6(–7) µm, 5.5 × 5.1 µm on average 35

35(34) Basidiomata ≤10 mm thick; 5–7 pores/mm; when on vertical substrate or obliquely on horizontal substrate, pseudopileus minutely present .... ***F. impercepta***

35* Basidiomata, up to 25 mm thick; (4–)5–9 pores/mm; when on vertical substrate or obliquely on horizontal substrate, prominent pseudopileus present ...... ***F. elliptica*** ad int.

DISCUSSION

Fomitiporia in Brazil

The use of an integrative taxonomy study allowed an increase and better understand of *Fomitiporia* species in Brazil. Nine species are proposed here and *F. castilloi* and *F. impercepta* are reported for the first time. Continuum studies on *Fomitiporia* species have been revealing a high diversity that overtakes the species amount previously reported (Amalfi and Decock 2013; Amalfi et al. 2014; Alves-Silva et al. 2020b, a). Furthermore, misaddressed names from Eurasia (*F. punctata*: see *F. neotropica* and *F. impercepta* and *F. robusta*: see *F. apiahyna* s.lat.) and USA (*F. dryophila*: see *F. biformis* ad int. and *F. pseudopileata* ad int.) species were confirmed lacking here and species boundaries clarified.

The amount of so far unknown lineages from Brazil recovered in phylogeny in this study is aligned with high number of undescribed lineages found in previous studies from Ecuador, French Guiana and Central America (Amalfi and Decock 2013; Amalfi et al. 2014). Regarding the lineages found in Brazil, taxonomically assessed and treated here or previously, *F. bambusarum*, *F. impercepta*, *F. maxonii*, *F. neotropica*, *F. prolongata* ad int., and *F. subtilissima* present probably a Neotropical widespread distribution, whereas there are other endemic, possibly with particular ecological requirements (e.g. *F. apiahyna*, *F. atlantica*, *F. exigua* ad int., *F. nubicola*, *F. rhizophila* ad int.) (Li et al. 2016; Alves-Silva et al. 2020a, b). Both species groups have cryptic diversity, with no obvious morphological differences in species complexes (see below).

Fomitiporia langloisii–F. castilloi clade

All Neotropical resupinate species have been recovered in a single clade nested with few pileate species (*F. bambusipileata*, *F. castilloi*, *F. exigua* ad int., and *F. rondoni* ad int.) (Amalfi and Decock 2013; Alves-Silva et al. 2020a). *Fomitiporia biformis* ad int. has resupinate specimens, but mostly basidiomata are pileate (see Taxonomy). The resupinate species is characterized and differentiate mostly in (group 1) bambusicolous species and other divided in two macroscopic character states, in which there are species with (group 2) persistent effused and thin basidiomata, while other (group 3) initially thin, with few tube layers, however sooner well delimited, thick, cushion-shaped to pseudopileate basidiomata. As in commonly observed in the genus, the microscopic characteristics are poorly distinguishable in the clade, only basidiospores in *F. dryophila* and *F. chilensis* and hymenial setae in the bambusicolous species, *F. ignea*, and *F. neotropica* could strongly help for species delimitation (Decock et al. 2007; Campos-Santana et al. 2014; Brown et al. 2019; Rajchenberg et al. 2019; Alves-Silva et al. 2020a). Furthermore, due to initial development stages of basidiomata, is hard to differentiate the species in this stage, then morphological and ecological data should be carefully obtained and assessed, as well as molecular data.

***Fomitiporia apiahyna* species complex**

Fomitiporia apiahyna was described in 1881 based on Apiaí-SP specimen and previously recognized to be widespread in Neotropics (Amalfi and Decock 2013). With morphological characters as follows: pileate, triquetrous to obtriquetrous basidiomata, concentrically zonate pileus, and strongly dextrinoid basidiospores, 5–6(–7) × (4–)5–6 µm; Amalfi and Decock (2013) and Alves-Silva et al. (2020b) recovered at least nine lineages into this morphological complex. In the last study, from recent Apiaí specimens Alves-Silva et al. (2020b) provided the *F. apiahyna* s.str. and described other three lineages (*F. nubicola*, *F. conyana*, and *F. murrilli*), besides *F. elegans* combination. In this study, we could assess other two remaining lineages, proposed as *F. melanoderma* ad int. and *F. prolongata* ad int.. The species boundaries assessing in this morphological complex demonstrates how crucial is integration of data. Even micromorphological features are mostly indistinct, pileus characters, basidiomata growth differences, and ecological particularities support species delimitation (see Taxonomy).

Poor morphological differentiation along Neotropical Fomitiporia lineages

Regarding morphological and ecological delimitation of *Fomitiporia* in Neotropics, it is possible found the following patterns: 1) species with no obvious morphological differentiation, as *F. apiahyna* s.lat. and some species from *F. langloisii*–*F. castilloi* clade; 2) species with macroscopic and/ microscopic features easily distinguishable (e.g. *F. atlantica*–*F. subtilissima* clade species, *F. rhizophila* ad int., *F. texana*); and 3) lineages with host-exclusivity relationships, as the bambusicolous species and *F. nubicola*. Poor morphological differences above mentioned in first group could be explained by recent speciation (Taylor et al. 2000, 2006). While for group 3, it is expected an ecological speciation (Wiens 2011; Rabosky 2013; Sánchez-García and Matheny 2017), with probably bambusicolous life-style as a synapomorphy in the group. However, would recent and ecological speciation be the only explanations for *Fomitiporia* diversity patterns?

Recent study on Agaricomycetes diversification analyses inferred shifts to higher diversification rates in the last common ancestor of Hymenochaetales (mean net diversification: 0.13), as well as *Fomitiporia* (0.25) (Varga et al. 2019). There are at least two characteristics that could be related to shifts on diversification rates in *Fomitiporia*. First, *Fomitiporia* has wood-inhabiting species, with living and standing dead trees as common hosts (Urcelay et al. 2000; Dai et al. 2008; Amalfi et al. 2012; Amalfi and Decock 2013; Alves-Silva et al. 2020b) and species occur both on wild and exotic hosts (Fischer 2006; Cabrera et al. 2014; Morera et al. 2017; Brown et al. 2019; Alves-Silva et al. 2020b). Thus, intimal fungus-host relationships and niche occupation capability could shape the speciation rates, such as abovementioned.

Second, last phylogenies reflected occurrence in biogeographical realms, e.g. Neotropical species in a unique clade, including species extending to north (southern USA) and south (southern South America) extremes, possibly due to dispersion, as the hypothesis concerning ancestral area of the common-ancestor of Neotropical-species clade was likely tropical. Nevertheless, the data and analyses provided are incipient in order to assess more specifically *Fomitiporia* diversity and biogeographical patterns. For further studies, to address what has been shaping *Fomitiporia* speciation, ancestral area and diversification rate shifts analyses approach should be conducted with a broader dataset.

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LEGENDS

Figure 1. Phylogenetic tree of *Fomitiporia* based on ML analysis of combined ITS, 28S, *TEF1*, and *RPB2* sequences. Black filled circles represent BS/BPP = 99%/0.99 or higher. Bold font is used to indicate sequences provided here. Black rectangles indicate newly species proposed.

Figure 2. Morphological features of *Fomitiporia melanoderma* ad int.. ICN(GAS893). Basidioma *in situ* (A). Basidiomata *ex situ* (B–D). B. Tube layers and dark crust; C. Abhymenial surface; D. Triquetrous basidioma. Basidiospores (E–F). E. Strongly dextrinoide; F. Moderately dextrinoid. Bars: A–D = 30 mm, E–F = 5 µm.

Figure 3. Morphological features of *Fomitiporia prolongata* ad int.. Basidiomata *in situ* (A, D). A. Abhymenial surface, ICN(GAS1139); D. Hymenophore, ICN(GAS884). Basidiomata *ex situ* (B–C). Evidenced the prolongated basidiomata in inferior surface. B. ICN(GAS1139); C. ICN(GAS880). Basidiospores (E–F). E. Moderately dextrinoide, ICN(GAS903); F. Strongly dextrinoid, ICN(GAS915). Bars: A–D = 30 mm, E–F = 5 µm.

Figure 4. Morphological features of *Fomitiporia puiggarii* ad int.. Basidiomata *ex situ* (A–E). A–C. Old specimen, FLOR58555. A. Abhymenial surface; B. Hymenophore; C. Tube

layers. D–E. Young specimen, ICN(MAR1247). D. Hymenophore; E. Abhymenial surface. Strongly dextrinoid basidiospores (F–G). F. ICN(MAR1247); G. FLOR58555. Bars: A–E = 30 mm, F–G = 5 µm.

Figure 5. Morphological features of *Fomitiporia biformis* ad int.. Basidiomata *in situ* (A–E). A, C. Resupinate basidiomata. A. ICN(GAS890); C. ICN(GAS891); B. Intermediate morphology ICN(GAS978); D–E. Pileate basidiomata, ICN(GAS980). Basidiospores (F–G) ICN(GAS980). F. Moderately dextrinoide; G. Strongly dextrinoid. Bars: A–E = 30 mm, F–G = 5 µm.

Figure 6. Morphological features of *Fomitiporia pulvinata* ad int.. ICN(GAS1073). General view of basidiomata *in situ* (A–C). Basidiospores (D–E). D. Moderately dextrinoid; E. Strongly dextrinoide. Bars: A–C = 30 mm, D–E = 5 µm.

Figure 7. Morphological features of *Fomitiporia elliptica* ad int.. Basidiomata *in situ* (A, C). A. Pseudopileate basidioma, ICN(GAS923). C. Cushion-shaped basidioma, FLOR58567. Basidioma *ex situ* (B). Pseudopileate basidioma ICN(DS1737). Basidiospores (D–F). D. Strongly dextrinoide, ICN(DS1737); E–F. Moderately to strongly dextrinoid, ICN(GAS923). Bars: A–C = 30 mm, D–F = 5 µm.

Figure 8. Morphological features of *Fomitiporia rondoni* ad int.. Basidiomata *in situ* (A). FLOR58557. Basidiomata *ex situ* (B–E). B–C. FLOR58557. B. Black line near to surface; C. Obtriquetrous basidioma. D–E. ICN(MEE). D. Whitish abhymenial surface; E. Triquetrous basidioma. Basidiospores (F–H). F. Strongly dextrinoide, FLOR58557; G–H. Moderately to strongly dextrinoid, ICN(MEE). Bars: A–E = 30 mm, F–H = 5 µm.

Figure 9. Morphological features of *Fomitiporia exigua* ad int.. FLOR58558. Basidiomata *ex situ* (A–E). Slightly dextrinoid basidiospores (F–G). Bars: A–C, E = 5 mm, D = 1 mm, F–G = 5 µm.

Figure 10. Morphological features of *Fomitiporia rhizophila* ad int.. General view of basidiomata *in situ* (A–C). A–B. ICN(GAS1072); C. ICN(GAS1071). Slightly dextrinoid basidiospores (D–G). D–E. ICN(GAS1071); F–G. ICN(GAS1072). Bars: A–C = 30 mm, D–G = 5 µm.

Table 1 Summary of specimens included in molecular analyses, for which geographical origin, herbarium vouchers, and GenBank accession numbers for each DNA region are provided. New sequences generated in this study are marked in **bold**.

Herbarium voucher	Locality	GenBank accession number			
		nrLSU	**nrITS**	**TEF–1α**	***RPB2***
F. aethiopica					
MUCL 44777 (T)	Ethiopia	AY618204	GU478341	GU461893	JQ087956
MUCL 44806	Ethiopia	AY618202	GU461944	GU461892	JQ087955
F. alpina					
Dai 15735	China	KX639645	KX639627	KX639664	KX639680
F. apiahyna					
FLOR 58553	Brazil	KU663291	KU663317	KU663342	–
ICN 200544	Brazil	MN918566	MN918573	MN918582	MN918589
ICN 200545	Brazil	–	MN918574	MN918583	MN918590
ICN 200546	Brazil	MN918567	MN918575	MN918584	MN918591
ICN 200542	Brazil	MN918564	MN918571	MN918580	MN918587
ICN 200543	Brazil	MN918565	MN918572	MN918581	MN918588
F. atlantica					
FLOR 58554 (T)	Brazil	KU557526	KU557528	–	–
F. australiensis					
MUCL 49406 PT	Australia	GU462001	AY624997	GU461897	JQ087959
F. baccharidis					
MUCL 47756	Argentina	JQ087913	JQ087886	JQ087940	JQ087993
MUCL 47757	Argentina	JQ087914	JQ087887	JQ087941	JQ087994
MUCL 47758	Argentina	JQ087915	JQ087888	JQ087942	JQ087995
F. bakeri					
MUCL 51098	USA	JQ087901	JQ087874	JQ087928	JQ087960
F. bambusarum					
ICN 200562	Brazil	MN918536	MN918543	MN918550	MN918557
ICN 200563	Brazil	MN918537	MN918544	MN918551	MN918558
ICN 200564	Brazil	MN918538	MN918545	MN918552	MN918559
F. bambusipileata					
ICN 200557 T	Brazil	MN918541	MN918548	MN918555	MN918562
ICN 200559 PT	Brazil	MN918539	MN918546	MN918553	MN918560
ICN 200560 PT	Brazil	MN918540	MN918547	MN918554	MN918561
F. bannaensis					
MUCL 45926	Thailand	EF429217	GU461942	GU461898	JQ087961
MUCL 46950	China	EF429218	GU461943	GU461899	JQ087962
F. biformis ad int. **sp. nov.**					
ICN (GAS811)	Brazil	**To be provided**	**To be provided**	**To be provided**	**To be provided**
ICN (GAS826)	Brazil	**To be provided**	**To be provided**	**To be provided**	**To be provided**
ICN (GAS890)	Brazil	**–**	**To be provided**	**To be provided**	**To be provided**
ICN (GAS891)	Brazil	**To be provided**	**To be provided**	**To be provided**	**To be provided**
ICN (GAS980)	Brazil	**To be provided**	**To be provided**	**To be provided**	**To be provided**
ICN (VOG159)	Brazil	**To be provided**	**To be provided**	**–**	**To be provided**
F. calkinsii					
MUCL 51100	USA	JQ087902	JQ087875	JQ087929	JQ087963

MUCL 52346	Mexico	JQ087903	JQ087876	JQ087930	JQ087964
F. capensis					
MUCL 53009	South Africa	JQ087917	JQ087890	JQ087944	JQ087997
F. castilloi					
MUCL 53481 (T)	French Guiana	JQ087916	JQ087889	JQ087943	JQ087996
MUCL 53980 (PT)	French Guiana	JX093830	JX093786	JX093743	JX093874
F. chilensis					
BAFC52942 T	Chile	MK193750	MK131089	MK156786	MK140500
BAFC52944	Chile	MK193751	MK131090	MK156788	MK140501
F. conyana					
ICN 200552	Brazil	MN918568	MN918576	–	–
FLOR 58563	Brazil	KU663273	KU663301	–	–
FURB 47595	Brazil	KU663272	KU663300	KU663326	KU663350
FLOR 58549	Brazil	KU663274	KU663302	KU663327	KU663351
FLOR 58548	Brazil	KU663271	KU663299	KU663325	KU663349
FLOR 58547	Brazil	KU663270	KU663298	KU663324	KU663348
FLOR 58546	Brazil	KU663269	KU663297	–	KU663347
ICN 200548	Brazil	**To be provided**	–	–	–
ICN 200551	Brazil	–	**To be provided**	–	–
ICN (GAS1008)	Brazil	–	**To be provided**	–	–
MUCL 51451	Ecuador	GU461997	GU461963	GU461896	JQ087958
MUCL 51454	Ecuador	JX093812	JX093769	JX093725	JX093856
MUCL 51456	Ecuador	JX093813	JX093770	JX093726	JX093857
MUCL 51474	Ecuador	JX093814	GU461961	JX093727	JX093858
MUCL 51485	Ecuador	GU461996	GU461962	GU461895	JQ087957
MUCL 53022	French Guiana	JX093815	JX093771	JX093728	JX093859
MUCL 53041	French Guiana	JX093816	JX093772	JX093729	JX093860
MUCL 53042	French Guiana	JX093817	JX093773	JX093730	JX093861
MUCL 53047	French Guiana	JX093818	JX093774	JX093731	JX093862
MUCL 53071	French Guiana	JX093819	JX093775	JX093732	JX093863
MUCL 53135	French Guiana	JX093820	JX093776	JX093733	JX093864
MUCL 53145	French Guiana	JX093821	JX093777	JX093734	JX093865
MUCL 53149	French Guiana	JX093822	JX093778	JX093735	JX093866
MUCL 53156	French Guiana	JX093823	JX093779	JX093736	JX093867
MUCL 53711	French Guiana	JX093824	JX093780	JX093737	JX093868
MUCL 53726	French Guiana	JX093829	JX093785	JX093742	JX093873
MUCL 53988	French Guiana	JX093825	JX093781	JX093738	JX093869
MUCL 53989	French Guiana	JX093826	JX093782	JX093739	JX093870
MUCL 53990	French Guiana	JX093827	JX093783	JX093740	JX093871
MUCL 53991	French Guiana	JX093828	JX093784	JX093741	JX093872
F. cupressicola					
MUCL 52486 (T)	Mexico	JQ087904	JQ087877	JQ087931	JQ087965
MUCL 52488	Mexico	JQ087905	JQ087878	JQ087932	JQ087966
MUCL 52489	Mexico	JQ087906	JQ087879	JQ087933	JQ087967
MUCL 52490	Mexico	JQ087907	JQ087880	JQ087934	JQ087968
F. dryophila					
MUCL 46379	USA	EF429221	EF429240	GU461902	JQ087969
MUCL 46380	USA	EF429219	EF429238	GU461900	JQ087970
F. elegans					

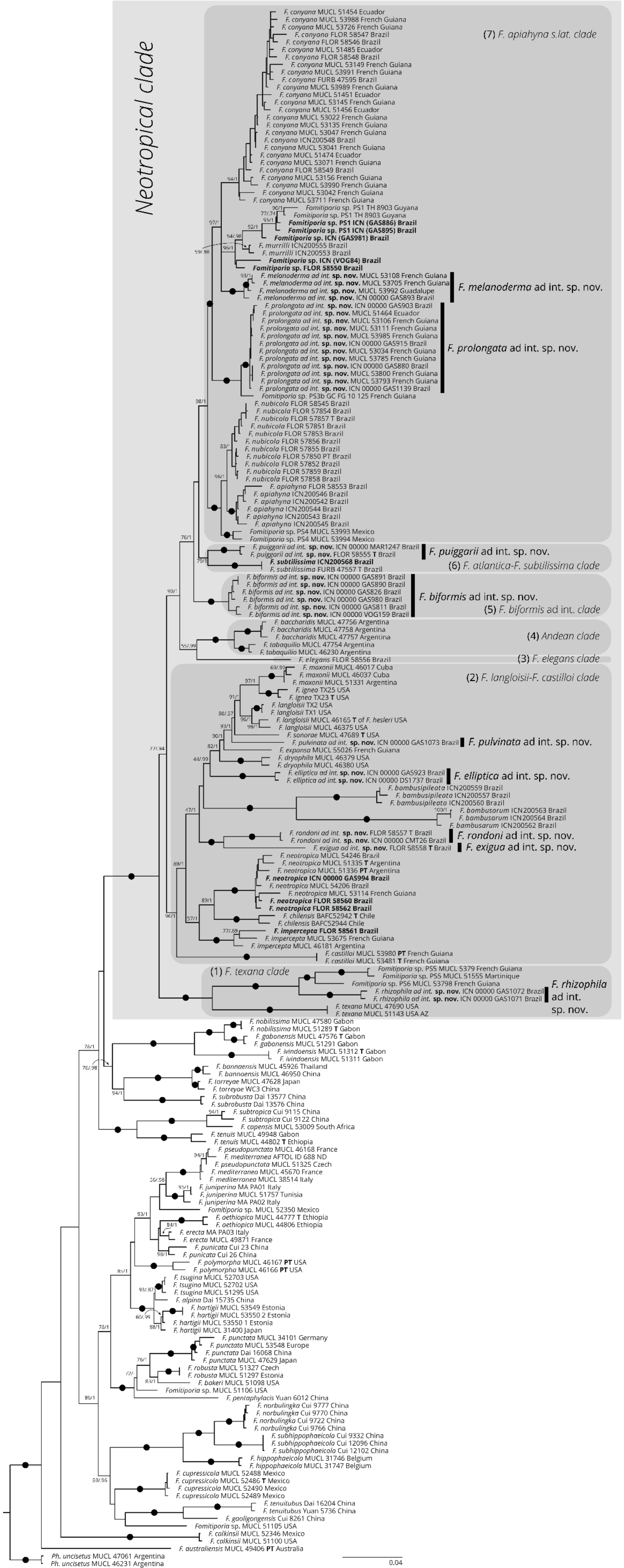
FLOR 58556	Brazil	KU663293	KU663319	KU663344	KU663368
FURB 44484	Brazil	–	KU663320	–	KU663369
F. elliptica ad int. **sp. nov.**					
ICN (DS1737)	Brazil	**KU663294**	**KU663321**	**KU663345**	**KU663370**
ICN (GAS923)	Brazil	**To be provided**	**To be provided**	**To be provided**	**To be provided**
F. erecta					
MUCL 49871	France	GU461976	GU461939	GU461903	JQ087971
MA PA03	Italy	KF444713	KF444690	KF444759	–
F. exigua ad int. **sp. nov.**					
FLOR 58558 T	Brazil	**KU663296**	**KU663323**	–	–
F. expansa					
MUCL 55026	French Guiana	KJ401032	KJ401031	KJ401033	KJ401034
F. gabonensis					
MUCL 47576 (T)	Gabon	GU461990	GU461971	GU461923	JQ087972
MUCL 51291	Gabon	GU461986	GU461967	GU461924	JQ087973
F. gaoligongensis					
Cui 8261	China	KX639642	KX639624	KX639663	KX639678
F. hartigii					
MUCL 31400	Japan	JQ087909	JQ087882	JQ087936	JQ087975
MUCL 53549	Estonia	JX093831	JX093787	JX093744	JX093875
MUCL 53550	Estonia	JX093832	JX093788	JX093745	JX093876
MUCL 53550	Estonia	JX093833	JX093789	JX093746	JX093877
F. hippophaeicola					
MUCL 31746	Belgium	AY618207	GU461945	GU461904	JQ087976
MUCL 31747	Belgium	GU461977	GU461946	GU461905	JQ087977
F. ignea					
TX23 Type	USA	MN113930	MN108104	MN114495	MN104158
TX25	USA	MN113931	MN108105	MN114496	MN104159
F. impercepta					
MUCL 46181	Argentina	EF429234	EF433563	GU461930	JQ088007
MUCL 53675	French Guiana	JX093835	JX093791	JX093748	JX093879
FLOR 58561	Brazil	**KU663288**	–	**KU663340**	**KU663365**
FLOR 58568	Brazil	–	**To be provided**	–	–
FLOR 58569	Brazil	–	**To be provided**	–	–
F. ivindoensis					
MUCL 51311	Gabon	GU461979	GU461952	GU461907	JQ087978
MUCL 51312 (T)	Gabon	GU461978	GU461951	GU461906	JQ087979
F. juniperina					
MA PA01	Italy	KF444726	KF444703	KF444776	KF444749
MA PA02	Italy	KF444727	KF444704	KF444777	KF444750
MUCL 51757	Tunisia	JQ087927	JQ087900	JQ087954	JQ088019
F. langloisii					
MUCL 46165 T of *F. hesleri*	USA	EF429223	AY340026	GU461909	JQ087981
MUCL 46375	USA	EF429225	EF429242	GU461908	JQ087980
TX1	USA	MN113932	MN108106	MN114497	MN104160
TX2	USA	MN113933	MN108107	MN114498	MN104161
F. maxonii					
MUCL 46017	Cuba	EF429230	EF433559	GU461910	JQ087983

MUCL 46037	Cuba	EF429231	EF433560	GU461911	JQ087982
MUCL 51331	Argentina	KF444714	KF444691	KF444764	–
INPA278267	Brazil	–	**To be provided**	–	–
F. mediterranea					
AFTOL ID 688	ND	AY684157	AY854080	AY885149	AY803748
MUCL 38514	Italy	AY618201	GU461953	GU461912	JQ087984
MUCL 45670	France	GU461980	GU461954	GU461913	JQ087985
F. melanoderma ad int. **sp. nov.**					
MUCL 53108	French Guiana	JX093839	JX093795	JX093752	JX093881
MUCL 53705	French Guiana	JX093840	JX093796	JX093753	JX093882
MUCL 53992	Guadalupe	JX093841	JX093797	JX093754	JX093883
ICN (GAS893)	Brazil	**To be provided**	**To be provided**	**To be provided**	**–**
F. murrilli					
ICN 200553	Brazil	MN918569	MN918577	MN918585	MN918592
ICN 200555	Brazil	MN918570	MN918578	MN918586	MN918593
F. neotropica					
MUCL 51335 (T)	Argentina	KF444721	KF444698	KF444771	KF444744
MUCL 51336 (PT)	Argentina	KF444722	KF444699	KF444772	KF444745
MUCL 53114	French Guiana	JX093836	JX093792	JX093749	JX093880
MUCL 54206	Brazil	KF444723	KF444700	KF444773	KF444746
MUCL 54246	Brazil	KF444720	KF444697	KF444770	KF444743
FLOR 58560	Brazil	**KU663287**	**KU663314**	**KU663338**	**KU663363**
FLOR 58562	Brazil	**–**	**KU663315**	**KU663339**	**KU663364**
FLOR 58565	Brazil	**–**	**To be provided**	**–**	**–**
ICN (GAS994)	Brazil	**To be provided**	**–**	**–**	**–**
F. nobilissima					
MUCL 47580	Gabon	GU461985	GU461966	GU461921	JQ087986
MUCL 51289 (T)	Gabon	GU461984	GU461965	GU461920	JQ087987
F. norbulingka					
Cui 9722	China	KU364429	KU364419	KU364434	KU364440
Cui 9766	China	KU364427	KU364417	KU364431	KU364438
Cui 9770	China	KU364430	KU364420	KU364433	KU364441
Cui 9777	China	KU364428	KU364418	KU364432	KU364439
F. nubicola					
FLOR 57850 (T)	Brazil	KU663275	KU663303	KU663328	KU663352
FLOR 57851	Brazil	KU663276	KU663304	KU663329	KU663353
FLOR 57852	Brazil	KU663277	KU663305	KU663330	KU663354
FLOR 57853	Brazil	KU663278	KU663306	KU663331	KU663355
FLOR 57854	Brazil	KU663279	–	KU663332	KU663356
FLOR 57855	Brazil	KU663280	KU663307	KU663333	KU663357
FLOR 57856	Brazil	KU663281	KU663308	–	KU663358
FLOR 57857	Brazil	KU663282	KU663309	KU663334	KU663359
FLOR 57858	Brazil	KU663283	KU663310	KU663335	KU663360
FLOR 57859	Brazil	KU663284	KU663311	KU663336	KU663361
FLOR 58545	Brazil	KU663285	KU663312	KU663337	KU663362
FURB 52808	Brazil	–	MN918579	–	–
F. pentaphylacis					
Yuan 6012	China	JQ003901	JQ003900	KX639671	KX639683

F. polymorpha					
MUCL 46166 (PT)	USA	DQ122393	GU461955	GU461914	JQ087988
MUCL 46167 (PT)	USA	EF429233	GU461956	GU461915	JQ087989
F. prolongata ad int. **sp. nov.**					
MUCL 51464	Ecuador	JX093842	JX093798	JX093755	JX093884
MUCL 53034	French Guiana	JX093843	JX093799	JX093756	JX093885
MUCL 53106	French Guiana	JX093844	JX093800	JX093757	JX093886
MUCL 53111	French Guiana	JX093845	JX093801	JX093758	JX093887
MUCL 53785	French Guiana	JX093846	JX093802	JX093759	JX093888
MUCL 53793	French Guiana	JX093847	JX093803	JX093760	JX093889
MUCL 53800	French Guiana	JX093848	JX093804	JX093761	JX093890
MUCL 53985	French Guiana	JX093849	JX093805	JX093762	JX093891
ICN (GAS1139)	Brazil	**To be provided**	**To be provided**	**To be provided**	**To be provided**
ICN (GAS880)	Brazil	**To be provided**	**To be provided**	**To be provided**	**To be provided**
ICN (GAS903)	Brazil	**To be provided**	**To be provided**	**–**	**To be provided**
ICN (GAS915)	Brazil	**To be provided**	**–**	**To be provided**	**To be provided**
F. pseudopunctata					
MUCL 46168	France	JQ087918	JQ087891	JQ087945	JQ087999
MUCL 51325	Czech	GU461981	GU461948	GU461916	JQ087998
F. puiggarii ad int. **sp. nov.**					
FLOR 58555 T	Brazil	**KU663292**	**KU663318**	**KU663343**	**KU663367**
ICN (MAR1247)	Brazil	**To be provided**	**To be provided**	**To be provided**	**To be provided**
F. pulvinata ad int. **sp. nov.**					
ICN (GAS1073)	Brazil	**To be provided**	**To be provided**	**To be provided**	**To be provided**
F. punctata					
MUCL 34101	Germany	AY618200	GU461947	GU461917	JQ088000
MUCL 47629	Japan	GU461982	GU461950	GU461918	JQ088001
MUCL 53548	Europe	JX093834	JX093790	JX093747	JX093878
Dai 16068	China	KX639648	KX639630	KX639666	KX639682
F. punicata					
Cui 23	China	GU461991	GU461974	GU461927	JQ088002
Cui 26	China	GU461992	GU461975	GU461928	JQ088003
F. rhizophila ad int. **sp. nov.**					
ICN (GAS1071)	Brazil	**To be provided**	**To be provided**	**To be provided**	**To be provided**
ICN (GAS1072)	Brazil	**To be provided**	**To be provided**	**To be provided**	**To be provided**
F. robusta					
MUCL 51297	Estonia	JQ087919	JQ087892	JQ087946	JQ088004
MUCL 51327	Czech	GU461993	GU461949	GU461929	JQ088005
F. rondoni ad int. **sp. nov.**					
FLOR 58557 T	Brazil	**KU663295**	**KU663322**	**KU663346**	**KU663371**
ICN (CMT26)	Brazil	**To be provided**	**To be provided**	**To be provided**	**To be provided**
F. sonorae					
MUCL 47689 (T)	USA	JQ087920	JQ087893	JQ087947	JQ088006
F. spinescens					
ICN 200566	Brazil	-	MN918549	-	-
F. subhippophaeicola					
Cui 12096	China Tibet	KU364426	KU364421	KU364437	KU364442
Cui 12102	China Tibet	KU364424	KU364423	KU364435	KU364444

Cui 9332	China	KU364425	KU364422	KU364436	KU364443
F. subrobusta					
Dai 13576	China	KX639635	KX639617	KX639655	KX639672
Dai 13577	China	KX639636	KX639618	KX639656	KX639673
F. subtilissima					
FURB 47557 (T)	Brazil	KU557527	KU557531	KU557532	KU557533
ICN 200568	Brazil	**To be provided**	**–**	**To be provided**	**To be provided**
F. subtropica					
Cui 9115	China	KX639641	KX639623	KX639662	–
Cui 9122	China	KX639640	KX639622	KX639661	KX639677
F. tabaquilio					
MUCL 46230	Argentina	DQ122394	GU461940	GU461931	JQ088008
MUCL 47754	Argentina	GU461994	GU461941	GU461932	JQ088009
F. tenuis					
MUCL 44802 (T)	Ethiopia	AY618206	GU461957	GU461934	JQ088010
MUCL 49948	Gabon	GU461998	GU461958	GU461935	JQ088011
F. tenuitubus					
Dai 16204	China	KX639637	KX639619	KX639657	KX639674
Yuan 5736	China	JQ003903	JQ003902	KX639658	KX639681
F. texana					
MUCL 47690	USA	JQ087921	JQ087894	JQ087948	JQ088013
MUCL 51143	USA	JQ087922	JQ087895	JQ087949	JQ088014
F. torreyae					
MUCL 47628	Japan	JQ087923	JQ087896	JQ087950	JQ088015
WC3	China	JQ087924	JQ087897	JQ087951	JQ088016
F. tsugina					
MUCL 51295	USA	JQ087908	JQ087881	JQ087935	JQ087974
MUCL 52702	USA	JQ087925	JQ087898	JQ087952	JQ088017
MUCL 52703	USA	JQ087926	JQ087899	JQ087953	JQ088018
F. uncinata					
ICN 200561	Brazil	MN918542	-	MN918556	MN918563
Fomitiporia sp.					
MUCL 51105	USA	JQ087911	JQ087884	JQ087938	JQ087991
Fomitiporia sp.					
MUCL 51106	USA	JQ087910	JQ087883	JQ087937	JQ087990
Fomitiporia sp.					
MUCL 52350	Mexico	JQ087912	JQ087885	JQ087939	JQ087992
Fomitiporia sp.					
ICN (GAS981)	Brazil	**To be provided**	**To be provided**	**To be provided**	**To be provided**
Fomitiporia sp.					
ICN (VOG84)	Brazil	**To be provided**	**–**	**To be provided**	**To be provided**
FLOR 58550	Brazil	**KU663289**	**–**	**KU663341**	**KU663366**
Fomitiporia sp. PS1					
TH 8903	Guyana	JX093837	JX093793	JX093750	–
TH 8904	Guyana	JX093838	JX093794	JX093751	–
ICN (GAS886)	Brazil	**To be provided**	**To be provided**	**To be provided**	**To be provided**
ICN (GAS895)	Brazil	**To be provided**	**To be provided**	**To be provided**	**To be provided**
Fomitiporia sp. PS3b					
GC–FG–10–125	French Guiana	JX093850	JX093806	JX093763	JX093892

Fomitiporia sp. PS4					
MUCL 53993	Mexico	JX093851	JX093807	JX093764	JX093893
MUCL 53994	Mexico	JX093852	JX093808	JX093765	JX093894
Fomitiporia sp. PS5					
MUCL 51555	Martinique	JX093853	JX093809	JX093766	JX093895
MUCL 5379	French Guiana	JX093854	JX093810	JX093767	JX093896
Fomitiporia sp. PS6					
MUCL 53798	French Guiana	JX093855	JX093811	JX093768	JX093897
P. uncisetus					
MUCL 46231	Argentina	EF429235	GU461960	GU461937	JQ088020
MUCL 47061	Argentina	GU462000	GU461972	GU461938	JQ088021


Neotropical clade
(7) F. apiahyna s.lat. clade
F. conyana MUCL 51454 Ecuador
F. conyana MUCL 53988 French Guiana
F. conyana MUCL 53726 French Guiana
F. conyana FLOR 58547 Brazil
F. conyana FLOR 58546 Brazil
F. conyana MUCL 51485 Ecuador
F. conyana FLOR 58548 Brazil
F. conyana MUCL 53149 French Guiana
F. conyana MUCL 53991 French Guiana
F. conyana FURB 47595 Brazil
F. conyana MUCL 53989 French Guiana
F. conyana MUCL 51451 Ecuador
F. conyana MUCL 53145 French Guiana
F. conyana MUCL 51456 Ecuador
F. conyana MUCL 53022 French Guiana
F. conyana MUCL 53135 French Guiana
F. conyana MUCL 53047 French Guiana
F. conyana ICN200548 Brazil
F. conyana MUCL 53041 French Guiana
F. conyana MUCL 51474 Ecuador
F. conyana MUCL 53071 French Guiana
F. conyana FLOR 58549 Brazil
94/1
F. conyana MUCL 53156 French Guiana
F. conyana MUCL 53990 French Guiana
F. conyana MUCL 53042 French Guiana
F. conyana MUCL 53711 French Guiana
90/1
Fomitiporia sp. PS1 TH 8903 Guyana
77/.74
Fomitiporia sp. PS1 TH 8903 Guyana
97/1
95/1
Fomitiporia sp. PS1 ICN (GAS886) Brazil
92/1
Fomitiporia sp. PS1 ICN (GAS895) Brazil
54/.98
Fomitiporia sp. ICN (GAS981) Brazil
96/1
F. murrilli ICN200555 Brazil
59/.98
F. murrilli ICN200553 Brazil
Fomitiporia sp. ICN (VOG84) Brazil
Fomitiporia sp. FLOR 58550 Brazil
93/1
F. melanoderma ad int. **sp. nov.** MUCL 53108 French Guiana
F. melanoderma ad int. **sp. nov.** MUCL 53705 French Guiana
F. melanoderma ad int. **sp. nov.** MUCL 53992 Guadalupe
F. melanoderma ad int. **sp. nov.** ICN 00000 GAS893 Brazil
F. melanoderma ad int. sp. nov.
F. prolongata ad int. **sp. nov.** ICN 00000 GAS903 Brazil
F. prolongata ad int. **sp. nov.** MUCL 51464 Ecuador
F. prolongata ad int. **sp. nov.** MUCL 53106 French Guiana
F. prolongata ad int. **sp. nov.** MUCL 53111 French Guiana
F. prolongata ad int. **sp. nov.** MUCL 53985 French Guiana
F. prolongata ad int. **sp. nov.** ICN 00000 GAS915 Brazil
F. prolongata ad int. **sp. nov.** MUCL 53034 French Guiana
F. prolongata ad int. **sp. nov.** MUCL 53785 French Guiana
F. prolongata ad int. **sp. nov.** ICN 00000 GAS880 Brazil
F. prolongata ad int. **sp. nov.** MUCL 53800 French Guiana
F. prolongata ad int. **sp. nov.** MUCL 53793 French Guiana
F. prolongata ad int. **sp. nov.** ICN 00000 GAS1139 Brazil
F. prolongata ad int. sp. nov.
Fomitiporia sp. PS3b GC FG 10 125 French Guiana
98/1
F. nubicola FLOR 58545 Brazil
F. nubicola FLOR 57854 Brazil
F. nubicola FLOR 57857 T Brazil
F. nubicola FLOR 57851 Brazil
F. nubicola FLOR 57853 Brazil
F. nubicola FLOR 57856 Brazil
83/1
F. nubicola FLOR 57855 Brazil
F. nubicola FLOR 57850 PT Brazil
F. nubicola FLOR 57852 Brazil
F. nubicola FLOR 57859 Brazil
96/1
F. nubicola FLOR 57858 Brazil
F. apiahyna FLOR 58553 Brazil
F. apiahyna ICN200546 Brazil
F. apiahyna ICN200542 Brazil
F. apiahyna ICN200544 Brazil
F. apiahyna ICN200543 Brazil
F. apiahyna ICN200545 Brazil
Fomitiporia sp. PS4 MUCL 53993 Mexico
76/1
Fomitiporia sp. PS4 MUCL 53994 Mexico
F. puiggarii ad int. **sp. nov.** ICN 00000 MAR1247 Brazil
F. puiggarii ad int. **sp. nov.** FLOR 58555 **T** Brazil
F. puiggarii ad int. sp. nov.
79/1
F. subtilissima ICN200568 Brazil
(6) F. atlantica-F. subtilissima clade
F. subtilissima FURB 47557 T Brazil
F. biformis ad int. **sp. nov.** ICN 00000 GAS891 Brazil
F. biformis ad int. **sp. nov.** ICN 00000 GAS890 Brazil
90/1
F. biformis ad int. **sp. nov.** ICN 00000 GAS826 Brazil
F. biformis ad int. **sp. nov.** ICN 00000 GAS980 Brazil
F. biformis ad int. sp. nov.
F. biformis ad int. **sp. nov.** ICN 00000 GAS811 Brazil
(5) F. biformis ad int. clade
F. biformis ad int. **sp. nov.** ICN 00000 VOG159 Brazil
F. baccharidis MUCL 47756 Argentina
F. baccharidis MUCL 47758 Argentina
F. baccharidis MUCL 47757 Argentina
(4) Andean clade
55/.99
F. tabaquilio MUCL 47754 Argentina
F. tabaquilio MUCL 46230 Argentina
F. elegans FLOR 58556 Brazil
(3) F. elegans clade
69/.99
F. maxonii MUCL 46017 Cuba
F. maxonii MUCL 46037 Cuba
(2) F. langloisii-F. castilloi clade
97/1
F. maxonii MUCL 51331 Argentina
F. ignea TX25 USA
91/1
F. ignea TX23 **T** USA
F. langloisii TX2 USA
80/.57
F. langloisii TX1 USA
96/1
F. langloisii MUCL 46165 **T** of F. hesleri USA
93/1
98/1
F. langloisii MUCL 46375 USA
90/1
F. sonorae MUCL 47689 **T** USA
F. pulvinata ad int. **sp. nov.** ICN 00000 GAS1073 Brazil
F. pulvinata ad int. sp. nov.
82/1
F. expansa MUCL 55026 French Guiana
77/.94
44/.99
F. dryophila MUCL 46379 USA
F. dryophila MUCL 46380 USA
F. elliptica ad int. **sp. nov.** ICN 00000 GAS923 Brazil
F. elliptica ad int. **sp. nov.** ICN 00000 DS1737 Brazil
F. elliptica ad int. sp. nov.
F. bambusipileata ICN200559 Brazil
F. bambusipileata ICN200557 Brazil
F. bambusipileata ICN200560 Brazil
47/1
100/1
F. bambusarum ICN200563 Brazil
F. bambusarum ICN200564 Brazil
F. bambusarum ICN200562 Brazil
F. rondoni ad int. **sp. nov.** FLOR 58557 T Brazil
F. rondoni ad int. sp. nov.
F. rondoni ad int. **sp. nov.** ICN 00000 CMT26 Brazil
F. exigua ad int. **sp. nov.** FLOR 58558 **T** Brazil
F. exigua ad int. sp. nov.
F. neotropica MUCL 54246 Brazil
89/1
F. neotropica MUCL 51335 **T** Argentina
F. neotropica MUCL 51336 **PT** Argentina
F. neotropica ICN 00000 GAS994 Brazil
F. neotropica MUCL 54206 Brazil
F. neotropica MUCL 53114 French Guiana
89/1
F. neotropica FLOR 58560 Brazil
F. neotropica FLOR 58562 Brazil
96/1
57/1
F. chilensis BAFC52942 **T** Chile
F. chilensis BAFC52944 Chile
77/.89
F. impercepta FLOR 58561 Brazil
F. impercepta MUCL 53675 French Guiana
F. impercepta MUCL 46181 Argentina
F. castilloi MUCL 53980 **PT** French Guiana
F. castilloi MUCL 53481 **T** French Guiana
(1) F. texana clade
Fomitiporia sp. PS5 MUCL 5379 French Guiana
Fomitiporia sp. PS5 MUCL 51555 Martinique
Fomitiporia sp. PS6 MUCL 53798 French Guiana
F. rhizophila ad int. **sp. nov.** ICN 00000 GAS1072 Brazil
F. rhizophila ad int. sp. nov.
F. rhizophila ad int. **sp. nov.** ICN 00000 GAS1071 Brazil
F. texana MUCL 47690 USA
F. texana MUCL 51143 USA AZ
F. nobilissima MUCL 47580 Gabon
F. nobilissima MUCL 51289 **T** Gabon
F. gabonensis MUCL 47576 **T** Gabon
F. gabonensis MUCL 51291 Gabon
78/1
F. ivindoensis MUCL 51312 **T** Gabon
76/.98
F. ivindoensis MUCL 51311 Gabon
F. bannaensis MUCL 45926 Thailand
F. bannaensis MUCL 46950 China
F. torreyae MUCL 47628 Japan
94/1
F. torreyae WC3 China
F. subrobusta Dai 13577 China
F. subrobusta Dai 13576 China
94/1
F. subtropica Cui 9115 China
F. subtropica Cui 9122 China
F. capensis MUCL 53009 South Africa
F. tenuis MUCL 49948 Gabon
F. tenuis MUCL 44802 **T** Ethiopia
F. pseudopunctata MUCL 46168 France
94/1
F. mediterranea AFTOL ID 688 ND
F. pseudopunctata MUCL 51325 Czech
F. mediterranea MUCL 45670 France
56/.98
F. mediterranea MUCL 38514 Italy
95/1
F. juniperina MA PA01 Italy
F. juniperina MUCL 51757 Tunisia
F. juniperina MA PA02 Italy
Fomitiporia sp. MUCL 52350 Mexico
93/1
F. aethiopica MUCL 44777 **T** Ethiopia
F. aethiopica MUCL 44806 Ethiopia
84/1
F. erecta MA PA03 Italy
F. erecta MUCL 49871 France
F. punicata Cui 23 China
98/1
F. punicata Cui 26 China
F. polymorpha MUCL 46167 **PT** USA
85/1
F. polymorpha MUCL 46166 **PT** USA
F. tsugina MUCL 52703 USA
F. tsugina MUCL 52702 USA
93/.87
F. tsugina MUCL 51295 USA
F. alpina Dai 15735 China
F. hartigii MUCL 53549 Estonia
60/.99
F. hartigii MUCL 53550 2 Estonia
F. hartigii MUCL 53550 1 Estonia
88/1
F. hartigii MUCL 31400 Japan
78/1
F. punctata MUCL 34101 Germany
F. punctata MUCL 53548 Europe
F. punctata Dai 16068 China
76/1
F. punctata MUCL 47629 Japan
F. robusta MUCL 51327 Czech
72/-
F. robusta MUCL 51297 Estonia
83/1
F. bakeri MUCL 51098 USA
Fomitiporia sp. MUCL 51106 USA
86/1
F. pentaphylacis Yuan 6012 China
F. norbulingka Cui 9777 China
F. norbulingka Cui 9770 China
F. norbulingka Cui 9722 China
F. norbulingka Cui 9766 China
F. subhippophaeicola Cui 9332 China
F. subhippophaeicola Cui 12096 China
F. subhippophaeicola Cui 12102 China
F. hippophaeicola MUCL 31746 Belgium
F. hippophaeicola MUCL 31747 Belgium
F. cupressicola MUCL 52488 Mexico
59/.96
F. cupressicola MUCL 52486 **T** Mexico
F. cupressicola MUCL 52490 Mexico
F. cupressicola MUCL 52489 Mexico
F. tenuitubus Dai 16204 China
F. tenuitubus Yuan 5736 China
F. gaoligongensis Cui 8261 China
Fomitiporia sp. MUCL 51105 USA
F. calkinsii MUCL 52346 Mexico
F. calkinsii MUCL 51100 USA
F. australiensis MUCL 49406 **PT** Australia
Ph. uncisetus MUCL 47061 Argentina
Ph. uncisetus MUCL 46231 Argentina
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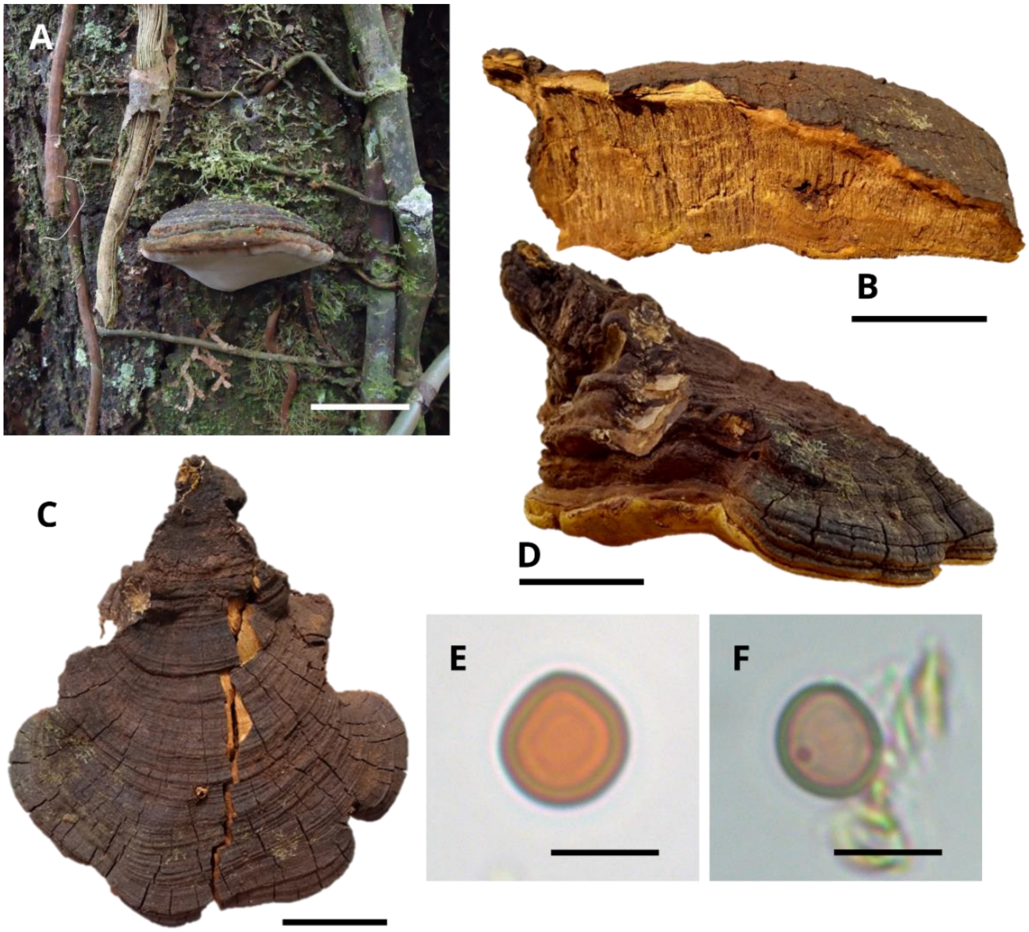
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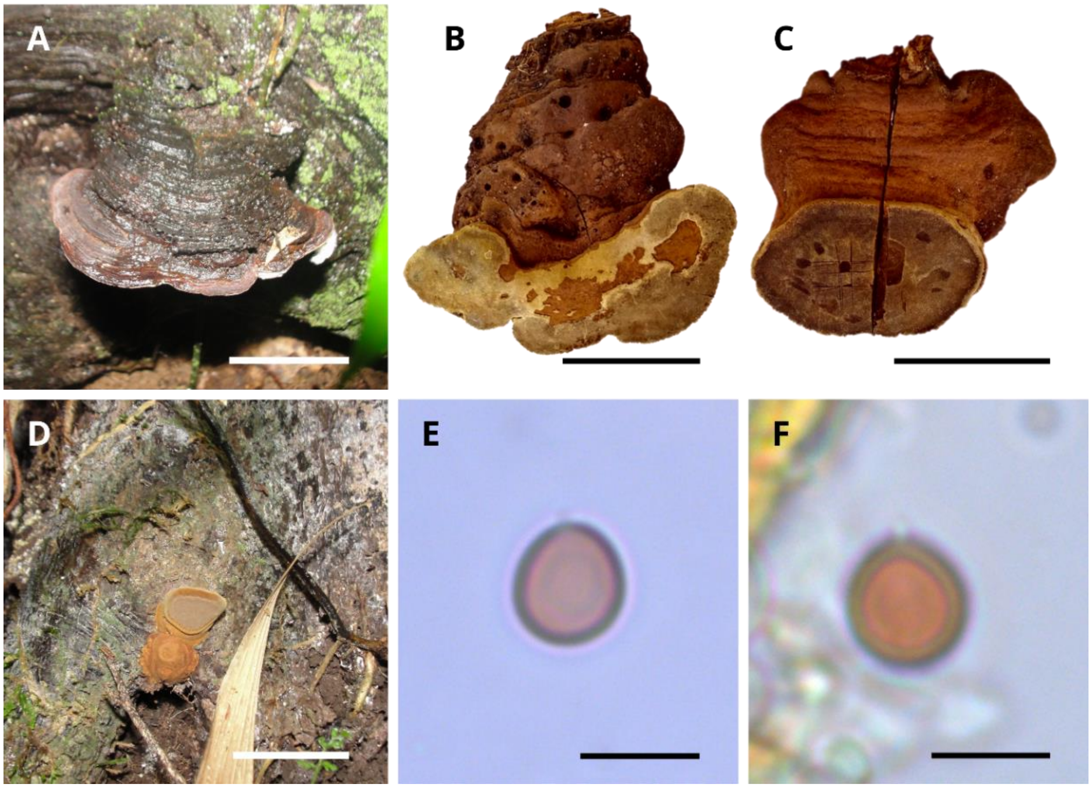
B
C
D
E
F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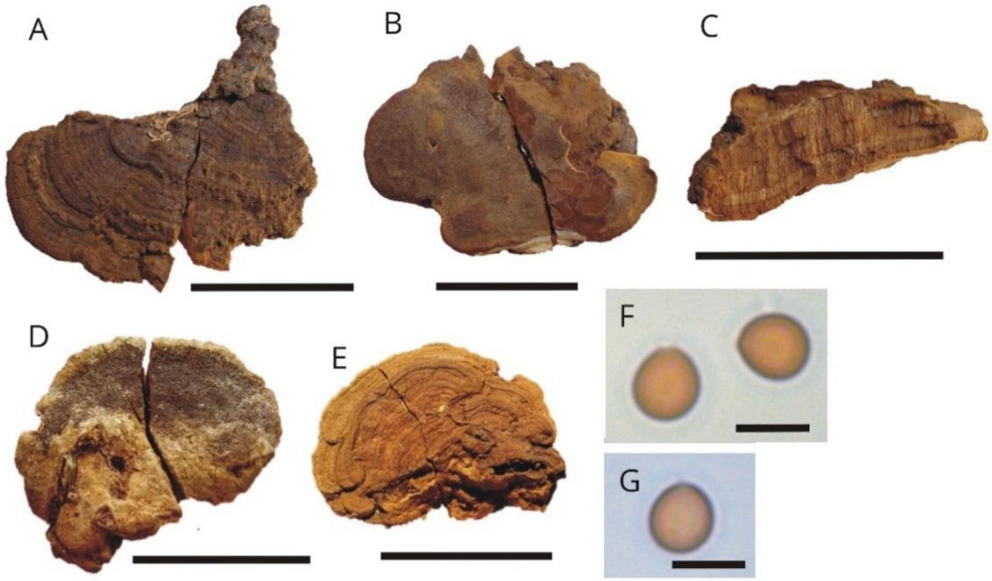
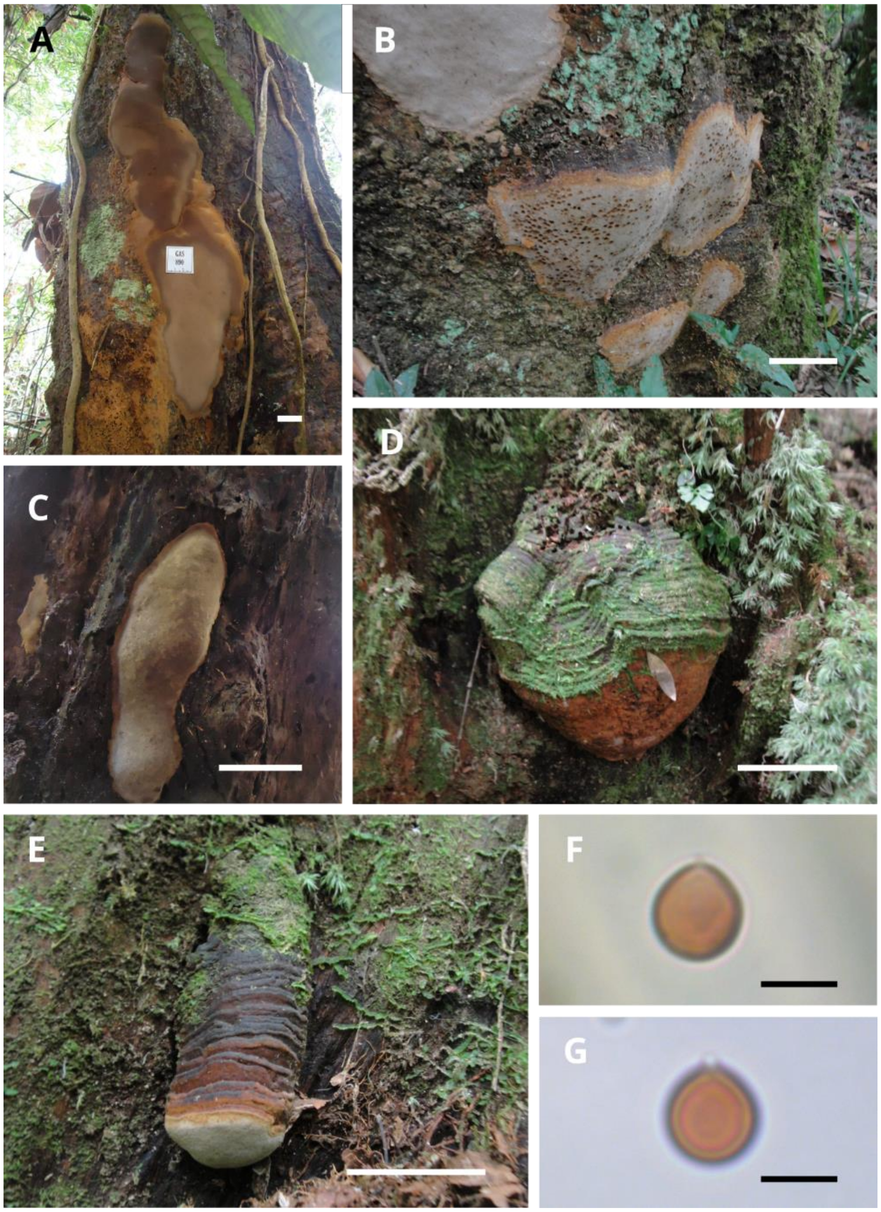


1296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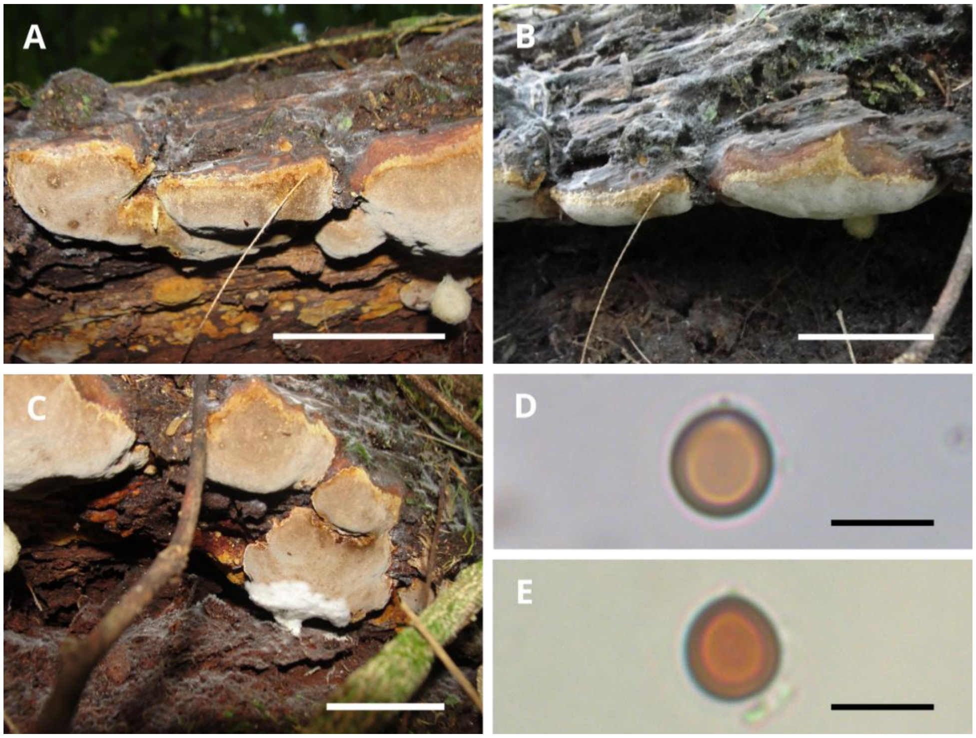
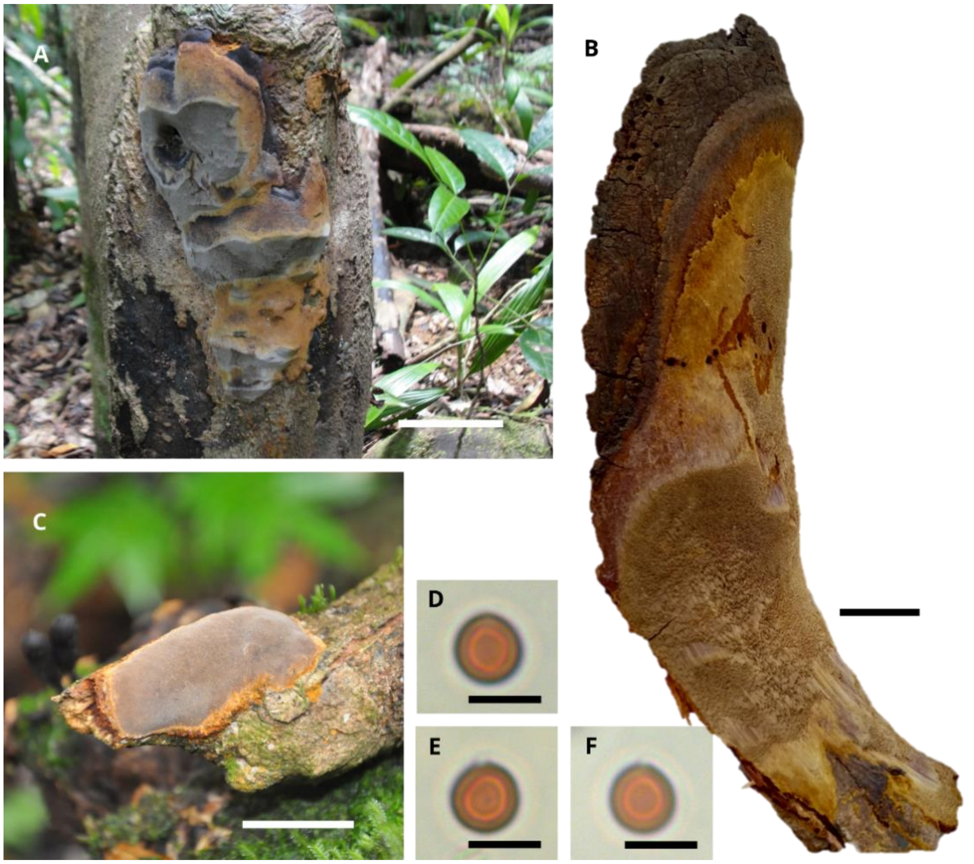
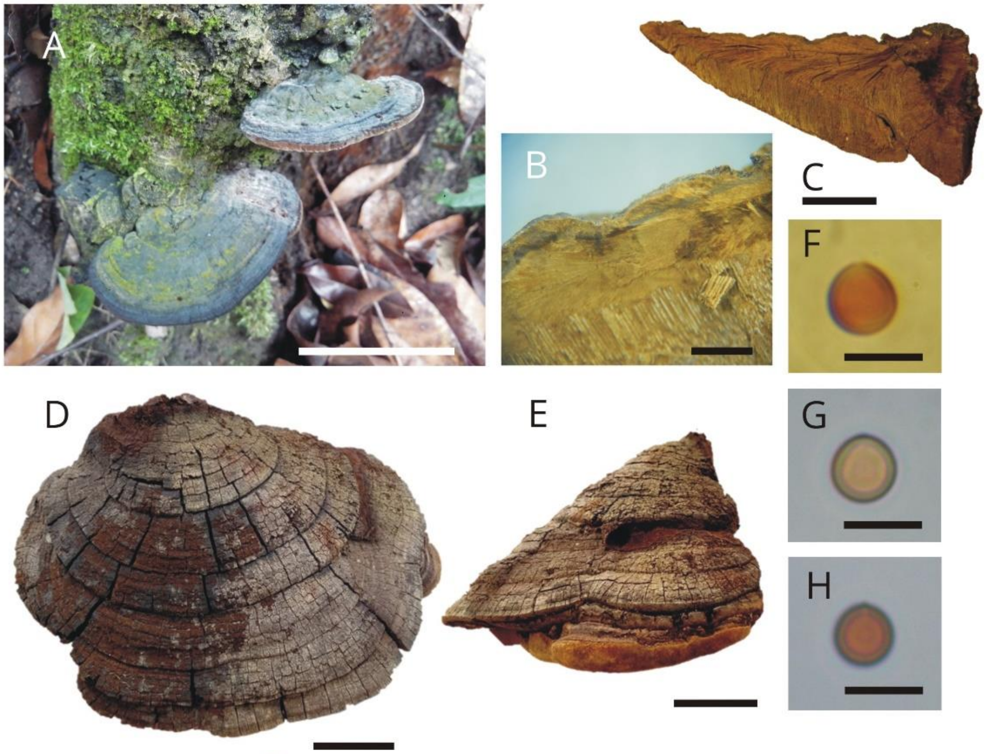


1298

1299



1300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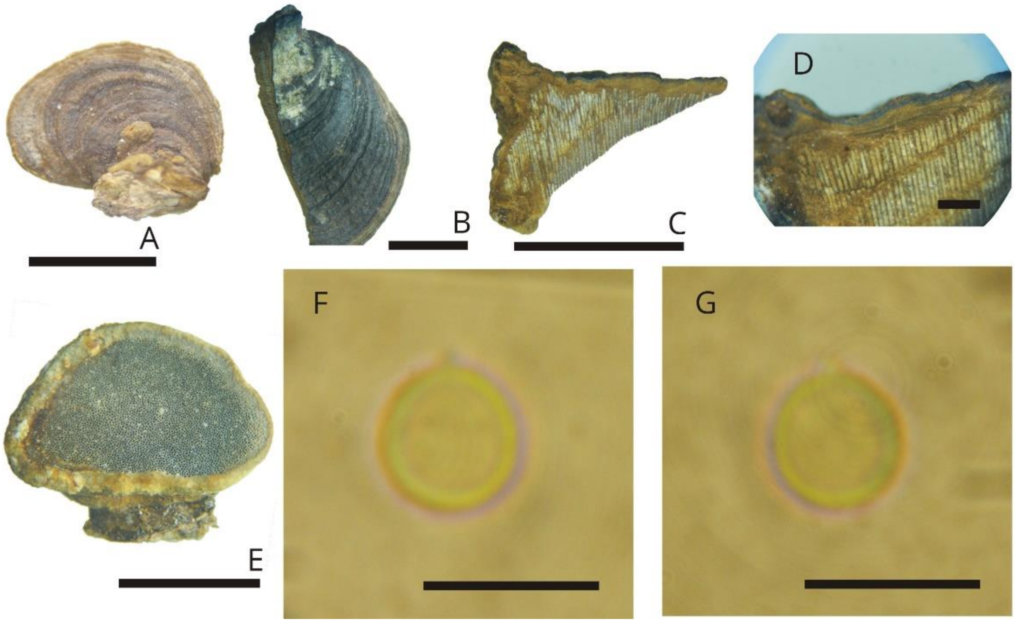
D
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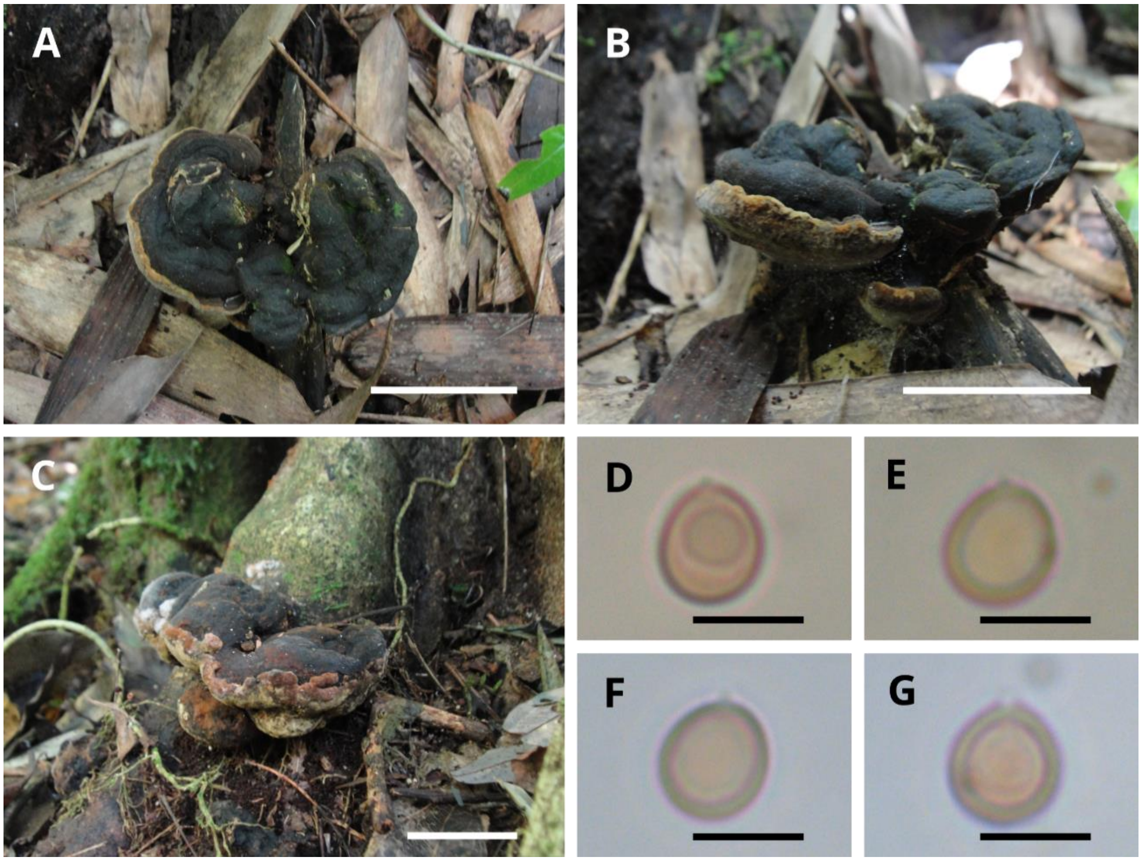
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SUPPLEMENTARY DATA

SUPPLEMENTARY FIGURE 1. Phylogenetic tree of *Fomitiporia* based on ML analysis of nrITS. Bold font is used to indicate the sequences provided in this study. Black rectangles indicate newly species proposed.

SUPPLEMENTARY TABLE 1. Summary of nrITS, 28S, *TEF1* and *RBP2* datasets.

SUPPLEMENTARY DATA 01

Fomitiporia neotropica

Specimens examined: BRAZIL, Amazonas: Manaus, Praça da saudade, on dead branches of living unidentified angiosperm, 13 Jul 2017, *G. Alves-Silva* 1177 (ICN); ibid., Reserva Ducke, on dead trunk, 10 May 2009, T.K. Kosonen 4740 (INPA 229171); ibid., Espírito Santo: Santa Teresa, Reserva Biológica Augusto Ruschi, on dead dangling trunk, unidentified angiosperm, 4 Dec 2012, *C. Salvador-Montoya* 505 (ICN); ibid., Mato Grosso: Cuiabá, Parque Nacional Chapada dos Guimarães, Sítio Véu de Noiva, 15°24'25.5"S 55°50'09.3"W, on below dead dangling trunk, unidentified angiosperm, 27 Dec 2016, *G. Alves-Silva* 994 (ICN); ibid., on dead branch, 5 Aug 2012, *G. Alves-Silva* 230 (ICN); ibid., *G. Alves-Silva* 249 (ICN); ibid., *G. Alves-Silva* 255 (ICN); ibid., on dead fallen branch, 27 Dec 2016, *G. Alves-Silva* 1004 (ICN); ibid., 10 Mar 2013, *G. Alves-Silva* 388 (ICN); ibid., 18 Aug 2013, *G. Alves-Silva* 507 (ICN); ibid., Paraná: Campo Mourão, Estação Ecológica do Cerrado, 24°01'01.3"S 52°21'37.3"W, on dead standing unidentified angiosperm, 24 Feb 2017, *G. Alves-Silva* 1059 (ICN); ibid., Cerrado patch, on dead dangling branch, 24 Feb 2017, *G. Alves-Silva* 1065 (ICN); ibid., Foz do Iguaçu, Parque Nacional do Iguaçu, on dead fallen branch, 27 Feb 2017, *G. Alves-Silva* 1101 (ICN); ibid., *G. Alves-Silva* 1102 (ICN); ibid., Jaguariaíva, Parque Estadual do Cerrado, on dead fallen branch, 3 Jun 2017, *G. Alves-Silva* 1128 (ICN); ibid., *G. Alves-Silva* 1129 (ICN); ibid., Piraquara, Morro do Canal, on dead unidentified angiosperm, 26 Jan 2014, *A. C. Magnago* 913 (ICN); ibid., Rio de Janeiro: Rio de Janeiro, Parque Nacional da Tijuca, on dead branch, 23 Nov 2014, *M.A. Reck* 817 (FLOR 58562); ibid., Rio Grande do Sul: Alegrete, Reserva Biológica Ibirapuitã, 29°55'00.1"S 55°45'56.2"W, on dead standing unidentified angiosperm, 31 Jul 2017, *G. Alves-Silva* 1191 (ICN); ibid., Barra do Quaraí, Parque Estadual do Espinilho, 30°11'37.3"S 57°29'19.3"W, on dead stump, 30 Jul 2017, *G. Alves-Silva* 1184 (ICN); ibid., Derrubadas, Parque Estadual do Turvo, 27°14'41"S 53°57'51"W, 360 m.a.s.l., 23 May 2017, *V. Oliveira-Garcia* 163 (ICN); ibid., *V. Oliveira-Garcia* 164 (ICN); ibid., El Dorado do Sul, Estação experimental da UFRGS, 30°6'2"s 51°41'30"W, 21 Dec 2016, *V. Oliveira-Garcia* 85 (ICN); ibid., Morrinhos do Sul, Lajeadinho, on dead tree, 13 Mar 2010, *M. Campos-Santana* 30 (ICN 190598: Paratype); ibid., Porto Alegre, Morro Santana, on dead branch in soil, 21 Oct 2016, *G. Alves-Silva* 965 (ICN); ibid., 27 Jul 2016, *G. Alves-Silva* 842 (ICN); ibid., on dead dangling branch in soil, 27 Jul 2016, *G. Alves-Silva* 849 (ICN); ibid., on dead standing trunk, unidentified angiosperm, 19 Jul 2016, *G. Alves-Silva* 833 (ICN); ibid., *G. Alves-Silva* 834 (ICN); ibid., *G. Alves-Silva* 835 (ICN); ibid., 30°3'42"S 51°7'35"W, 311, on living tree, 09 Jan 2017, *V. Oliveira-Garcia* 91 (ICN); ibid., Refúgio da Vida Silvestre - UFRGS, on dead branch, 16 Aug 2011, *M. Campos-Santana* (ICN 190601: Paratype); ibid., 30°03'S 51°07'W, on dead unidentified angiosperm, 31 May 2011, *M. Campos-Santana* 607 (ICN 179051); ibid., UFRGS, Campus Agronomia, on dead fallen trunk, unidentified angiosperm, 12 Sep 2016, *G. Alves-Silva* 857 (ICN); ibid., UFRGS, Campus do Vale, on dead dangling trunk, unidentified angiosperm, 1 May 2016, *G. Alves-Silva* 780 (ICN); ibid., Santa Maria, urban center, 29°41'50.3"S 53°49'36.3"W, on dead branch of living unidentified angiosperm, 1 Aug 2017, *G. Alves-Silva* 1203 (ICN); ibid., São Francisco de Paula, Floresta Nacional de São Francisco de Paula, 29°25'22.4"S 50°23'11.2"W, on dead branch, 26 Sep 2009, *M.C. Westphalen* 270 (ICN 154374); ibid., on dead standing unidentified angiosperm, 2 May 2016, E.P. Fazolino 676 (ICN); ibid., on dead unidentified angiosperm, 21 May 2011, *M. Campos-Santana* 558 (ICN 179029); ibid., 22 May 2011, *M. Campos-Santana* 572 (ICN 179037); ibid., Viamão, Parque Estadual de Itapuã, 30°22'40"S 51°1'23"W, on dead branch, 16 Oct 2010, *M. Campos-Santana* 319 (ICN 190600: Paratype); ibid., on dead branch of living unidentified angiosperm, 21 Apr 2017, *G. Alves-Silva* 1113 (ICN); ibid., on dead tree, 14 Dec 2017, *V. Oliveira-Garcia* 206 (ICN); ibid., *V. Oliveira-Garcia* 207 (ICN); ibid., on dead unidentified angiosperm, 16 Oct 2010, *M. Campos-Santana* 319 (ICN 178910); ibid., Rondônia: Vilhena, RO-399, 5-20 km on new road to Colorado, low mountain forest, 3 Nov 1979, R.H. Petersen 382 (INPA 110870); ibid., Santa Catarina: Concórdia, Parque Estadual Fritz Plaumann, on dead branch of living unidentified angiosperm, 14 Feb 2013, E.R. Drechsler-Santos 901 (ICN); ibid., on dead dangling branch, 14 Feb 2013, E.R. Drechsler-Santos 916 (ICN); ibid., Florianópolis, Lagoa do Peri, on dead branch in soil, 15 Feb 2014, Marília 18 (ICN); ibid., Morro da Lagoa da Conceição (CASAN), 27°33'38"S 48°27'13"W, 16 Jan 2012, *V. Ferreira-Lopes* 62 (FLOR 51128); ibid., on dead branch, 26 Jul 1988, C. Loguercio-Leite 252 (FLOR 10634); ibid., 30 May 1995, Gerber 673 (FLOR 11306); ibid., 27°35'09"S 48°28'37"W, on dead fallen branch, 15 Sep 2015, *G. Alves-Silva* 752 (FLOR 58560); ibid., on dead unidentified angiosperm, 24 Feb 1988, C. Loguercio-Leite 142 (FLOR 10584); ibid., on dead fallen unidentified angiosperm, 30 May 1995, Gerber 674 (FLOR

11188); ibid., Parque Municipal do Córrego Grande, 11 Feb 2016, *M.A. Reck* 1285 (ICN); ibid., *M.A. Reck* 1286 (ICN); ibid., Parque Municipal Lagoa do Peri, on dead branch, 16 Feb 2014, *G. Alves-Silva* 579 (ICN); ibid., 1 Oct 2016, E.P. Fazolino 691 (ICN); ibid., Parque Municipal Lagoa do Peri, Trilha do saquinho, on dead fallen trunk, unidentified angiosperm, 16 Feb 2014, E.R. Drechsler-Santos 1318 (ICN); ibid., on dead vine, 16 Feb 2014, E.R. Drechsler-Santos 1317 (ICN); ibid., Trilha Naufragados, 27°49'31.4"S 48°33'52.2"W, on cortex of living unidentified angiosperm, 5 Oct 2016, *G. Alves-Silva* 958 (ICN); ibid., UCAD, on dead dangling branch in soil, 22 Feb 2018, *G. Alves-Silva* 1314 (ICN); ibid., 5 Apr 2014, *G. Alves-Silva* 587 (ICN); ibid., UFSC, botany department, on dead branch of living unidentified angiosperm, 21 Mar 2014, *G. Alves-Silva* 583 (ICN); ibid., on dead fallen branch, 27 Mar 2014, *G. Alves-Silva* 584 (ICN); ibid., UFSC, RU, on dead branch of living unidentified angiosperm, 6 Dec 2013, *C. Salvador-Montoya* 557 (FLOR 58565); ibid., Unidade de Conservação Ambiental Desterro - UCAD, on dead branch, 02 Oct 2010, *M. Campos-Santana* 253 (ICN 190599: Paratype); ibid., Universidade Federal de Santa Catarina, on dead branch of living shrub (*Lagerstroemia indica*), 1 Dec 2013, *C. Salvador-Montoya* 555 (ICN); ibid., 1 Jun 2013, *C. Salvador-Montoya* 540 (ICN); ibid., Imaruí, 20 Jan 2005, Michels 372 (FLOR 31734); ibid., Itapoá, Reserva Particular do Pratrimônio Natural Volta Velha, 26°07'01"S 48°36'58"W, on dead unidentified angiosperm, 29 Apr 2013, *M. Campos-Santana* 671 (ICN 179082); ibid., Major Gercino, on dead unidentified angiosperm, 11 Aug 1993, Z. Willerding 276 (FLOR 10905); ibid., Palhoça, Parque Estadual Serra do Tabuleiro, Baixada do Maciambu, 27°50'41.4"S 48°37'30.1"W, 2 Mar 2011, CALD 9 (ICN); ibid., 23 Mar 2011, CALD 16 (ICN); ibid., Paulo Lopes, 10 Oct 2004, Michels 147 (FLOR 31613); ibid., 4 Sep 2004, Michels 84 (FLOR 31585); ibid., São Francisco de Assis, Parque

Estadual Acaraí, on dead fallen branch, 5 Aug 2014, *G. Alves-Silva* 611 (ICN); ibid., *G. Alves-Silva* 612 (ICN); ibid., Parque Estadual Acaraí, módulo PPBio Acaraí (.75), 26°19'50.8"S 48°33'46.2"W, on dead fallen branch, 6 Aug 2014, *G. Alves-Silva* 617 (ICN); ibid., Urubici, Parque Nacional de São Joaquim, Santa Barbara, in beginning *Dicksonia* trail, 21 Oct 2013, E.R. Drechsler-Santos 1142 (ICN); ibid., São Paulo: Itapecerica da Serra, on dead branch, 16 Jan 1997, A.M. Gugliotta 700 (SP 307273); ibid., Mogi-Guaçu, Fazenda Campininha, 16 Sep 1977, V.L. Penteado (SP 142125); ibid., V.L. Penteado (SP 142134); ibid., 18 Aug 1977, V.L. Penteado (SP 142170); ibid., Santo André, Reserva Biológica do Alto da Serra de Paranapiacaba, 28 Jul 1990, M. Capelari 3531A (SP 307447); ibid., São Paulo, Parque Alfredo Volpi, 23°35'S 46°42'W, 17 Sep 2009, S.P. Macedo 14 (SP 416257); ibid., Parque Estadual da Cantareira, Núcleo Engordador, on dead branch, 6 Jun 2011, V. Motato-Vásquez 76 (SP 417862); ibid., 6 Jun 2011, V. Motato-Vásquez 57 (SP 417861); ibid., Parque Estadual das Fontes do Ipiranga, 26 Mar 1996, A.M. Gugliotta (SP 251080).

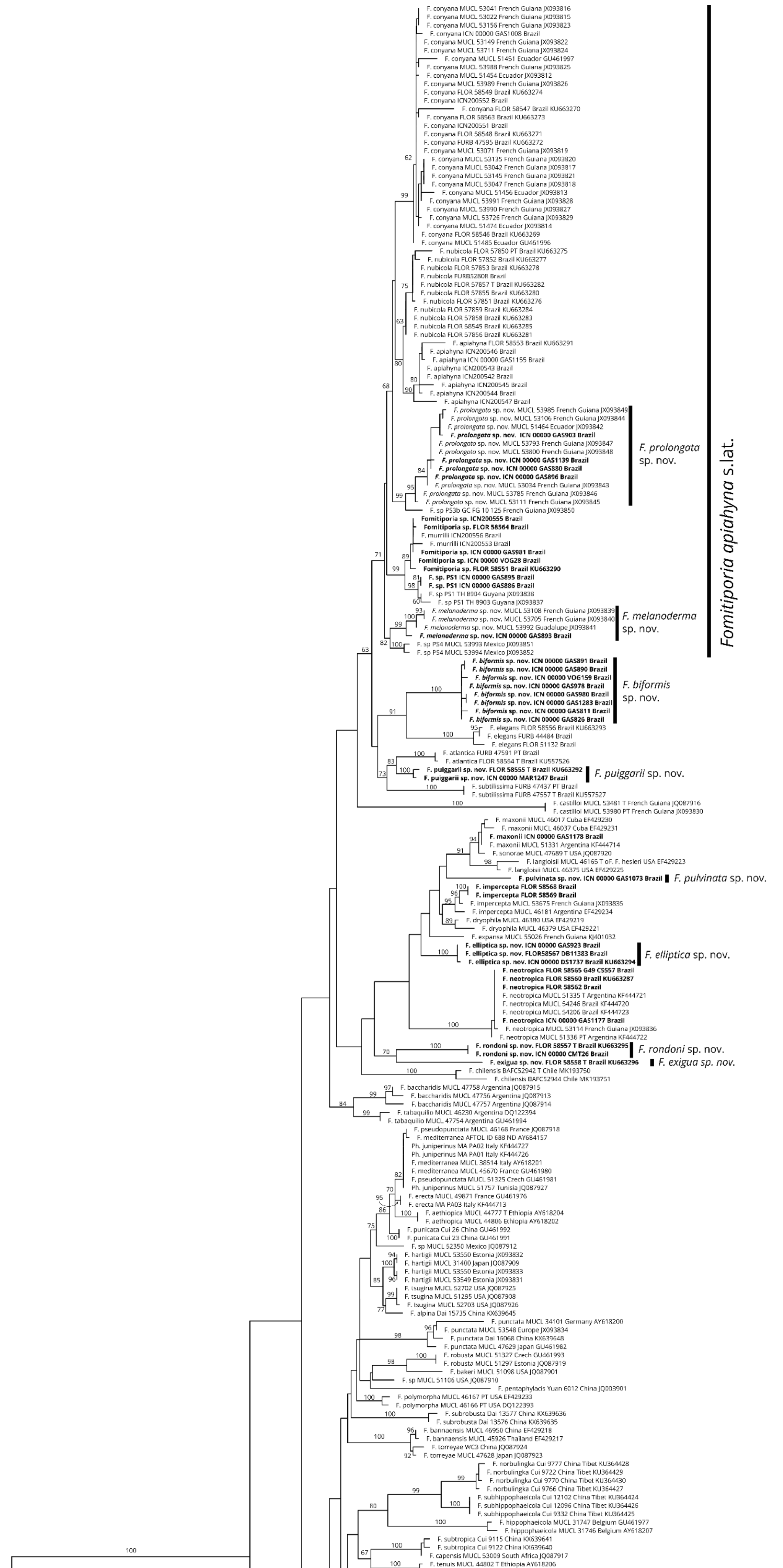
SUPPLEMENTARY DATA 02

Fomitiporia impercepta

Specimens examined: ARGENTINA, Misiones: Puerto Iguazú, Parque Nacional de Iguazú, on dead fallen trunk, unidentified angiosperm, 23 Mar 2017, *C. Salvador-Montoya* 800 (ICN); ibid., BRAZIL, Bahia: Salvador, Pousada Parate, on living tree (*Inga* sp.); ibid., 23 Feb 2014, *C. Salvador-Montoya* 560 (ICN); ibid., Mato Grosso: Chapada dos Guimarães, Parque Nacional Chapada dos Guimarães, Sítio Véu de Noiva, 15°24'25.5"S 55°50'09.3"W, on dead dangling branch, 5 Aug 2012, *G. Alves-Silva* 240 (ICN); ibid., Paraná: Guarapuava, Parque Municipal das Araucárias, on living unidentified angiosperm, 22 Feb 2017, *G. Alves-*

Silva 1037 (ICN); ibid., Rio Grande do Sul: Barra do Quaraí, Parque Estadual do Espinilho, 30°10'26.6"S 57°31'10.5"W, on dead branch in living unidentified angiosperm, 30 Jul 2017, *G. Alves-Silva* 1183 (ICN); ibid., Derrubadas, Parque Estadual do Turvo, on dead dangling trunk, unidentified angiosperm, 30 Oct 2017, *G. Alves-Silva* 1226 (ICN); ibid., Guaíba, Fazenda São Maximiano, 30°10'47"S 51°23'33"W, 198 m.a.s.l., on living tree, 11 Nov 2017, *V. Oliveira-Garcia* 204 (ICN); ibid., Muitos Capões, Estação Ecológica de Aracurí, 8 Dec 2017, *M.P. Palacio* 284 (ICN); ibid., Porto Alegre, Morro Santana, on dead branch, 14 Dec 2007, *M.C. Westphalen* 76 (ICN154128); ibid., on living unidentified angiosperm, 21 Oct 2016, *G. Alves-Silva* 970 (ICN); ibid., São Francisco de Paula, Floresta Nacional de São Francisco de Paula, 24 Apr 2009, *M.C. Westphalen* 161 (ICN154308); ibid., Pró-Mata, on dead unidentified angiosperm, 17 May 2018, *S. C. Feuerstein* (ICN); ibid., Veraneio Hampel, on dead stump, 23 May 2016, *G. Alves-Silva* 812 (ICN); ibid., 29°26'52"S 50°35'02"W, on dead unidentified angiosperm, 6 May 2013, *M. Campos-Santana* 57 (ICN 178810); ibid., Sarandi, Parque Estadual Papagaio Charão, 27°54'28,8"S 52°49'21,0"W, on living unidentified angiosperm, 31 Oct 2017, *G. Alves-Silva* 1230 (ICN); ibid., Viamão, Parque Estadual de Itapuã, on branch in dead standing unidentified angiosperm, 21 Apr 2017, *G. Alves-Silva* 1115 (ICN); ibid., on dead dangling branch, 21 Apr 2017, *G. Alves-Silva* 1117 (ICN); ibid., on dead fallen trunk, 21 Apr 2017, *G. Alves-Silva* 1114 (ICN); ibid., Santa Catarina: Águas Mornas, Reserva Particular do Pratrimônio Natural Sítio Portal, 900 m.a.s.l., 26 Oct 2013, *R. Fagundez-Fernandez* 119 (FLOR 51646); ibid., 18 Jan 2005, *Michels* (FLOR 31691); ibid., Concórdia, Parque Estadual Fritz Plaumann, trilha da canafístula, on dead fallen branch, 21 Dec 2011, *E.R. Drechsler-Santos* 729 (ICN); ibid., on dead standing trunk (*Peltophorum dubium*), 22 Dec 2014, *G. Alves-Silva* 700 (ICN); ibid., trilha do Lajeado

Cruzeiro, on living unidentified angiosperm, 21 Dec 2011, *E.R. Drechsler-Santos* 752 (ICN); ibid., trilha do mirante, 22 Dec 2014, *G. Alves-Silva* 712 (FLOR 58568); ibid., Florianópolis, Lagoa do Peri, Trilha do Saquinho, dead branch of living tree (*Sebastiana* cf. *comercionana*), 16 Feb 2014, *E.R. Drechsler-Santos* 1315 (ICN); ibid., on dead branch of living unidentified angiosperm, 16 Feb 2014, *E.R. Drechsler-Santos* 1319 (ICN); ibid., Morro da Lagoa, CASAN, 15 Sep 2015, *S. Galvão-Elias* (FLOR 58561); ibid., Parque Municipal do Córrego Grande, 11 Feb 2016, *M.A. Reck* 1288 (ICN); ibid., Joaçaba, Parque Ecológico Municipal Rio do Peixe, on dead fallen branch, 28 Sep 2014, *G. Alves-Silva* 626 (ICN); ibid., Mondaí, Linha Sanga Forte, on dead angiosperm (*Nectandra membranaceae*), 3 Jan 2006, *M. Campos-Santana* 31 (FLOR 32228); ibid., 27°06'16"S 53°24'07"W, 235 m.a.s.l., on dead unidentified angiosperm, 10 Dec 2010, *M. Campos-Santana* 434 (ICN 178954); ibid., *M. Campos-Santana* 435 (ICN 178955); ibid., on dead unidentified angiosperm, 25 May 2007, *M. Campos-Santana* 292 (FLOR 32229); ibid., Santo Amaro da Imperatriz, Parque Estadual Serra do Tabuleiro, on dead branch, 16 Jan 2017, *M. Palacio* 189 (ICN); ibid., São Bonifácio, on dead standing unidentified angiosperm, 17 Dec 2004, *Michels* 222 (FLOR 31655); ibid., Tubarão, 23 Mar 2014, *A.G.S. Silva-Filho* 88 (ICN); ibid., Urubici, Parque Nacional São Joaquim, on dead fallen branch, 16 Feb 2013, *E.R. Drechsler-Santos* 933 (ICN); ibid., *Dicksonia* trail, on dead fallen branch, 4 Dec 2014, *G. Alves-Silva* 661 (FLOR 58569); ibid., São Paulo: Cananéia, Ilha do Cardoso, waterfall trail, on dead unidentified angiosperm, 30 Aug 1977, *V.L. Penteado* (SP 141724); ibid., *V.L. Penteado* (SP 141725); ibid., Ilha do Cardoso, near to R. Tapera, on dead unidentified angiosperm, 22 Jul 1981, *V.L. Bononi* (SP 157407); ibid., Itapecerica da Serra, on dead fallen branch, 10 Jul 1997, *A.M. Gugliotta* 942 (SP 307274); ibid., Mogi-Guaçu, Fazenda Campininha, on dead unidentified angiosperm, 21 Sep 1978, *R.A. Píccolo* (SP 156809); ibid., São Paulo, Parque Estadual das Fontes do Ipiranga, on dead unidentified angiosperm, 30 Jul 1985, *M.A. de Jesus* (SP 211913).


Fomitiporia apiahyna s.lat.
F. prolongata sp. nov.
F. melanoderma sp. nov.
F. biformis sp. nov.
F. puiggarii sp. nov.
F. pulvinata sp. nov.
F. elliptica sp. nov.
F. rondoni sp. nov.
F. exigua sp. nov.
F. rhizophila sp. nov.
0.06

SUPPLEMENTARY TABLE 1 Summary of ITS, 28S, TEF1 and *RBP2* datasets.

Properties	Datasets											
	ITS1	5.8S	ITS2	28S	TEF1-1st	TEF1-2nd	TEF1-3rd	TEF1introns	*RPB2*-1st	*RPB2*-2nd	*RPB2*-3rd	Total
Model selected	HKY+G	SYM	HKY+G	GTR+I+G	GTR+I+G	HKY+I	GTR+G	HKY+G	GTR+I+G	HKY+G	GTR+I+G	
Likelihood score	–5,880.34	–396.52	–3,876.47	–4,097.40	–915.51	–689.29	–4,559.19	–2,725.36	–1,058.91	–610.56	–7,355.83	
Base frequencies												
Freq. A =	0.2902	Equal	0.2542	0.2624	0.3073	0.3060	0.1651	0.2807	0.2731	0.3049	0.2031	
Freq. C =	0.1852	Equal	0.1827	0.1982	0.1967	0.2548	0.3107	0.1855	0.2556	0.1880	0.1878	
Freq. G =	0.1846	Equal	0.1931	0.2937	0.3692	0.1603	0.2262	0.1659	0.3320	0.2100	0.2903	
Freq. T =	0.3401	Equal	0.3701	0.2458	0.1268	0.2789	0.2980	0.3679	0.1394	0.2970	0.3188	
Proportion of invariable sites	–	–	–	0.6030	0.6578	0.8100	–	–	0.6497	–	0.0480	
Gamma shape	0.9499	–	0.5658	0.5068	0.6657	–	1.6274	2.6176	1.4511	0.1343	2.0062	
Final DNA sequence alignment (bp)		920		899		994		201		813		3827
Variable parsimony-uninformative positions		84		47		52		12		37		232
Variable parsimony-uninformative positions (%)		9.13%		5.22%		5.23%		6%		4.55%		
Parsimony-informative positions		438		150		283		139		293		1303
Parsimony-informative positions (%)		47.60%		16.68%		28.47%		69.15%		36.00%		
Parsimony-informative positions from total of final alignment (%)		11.44%		3.91%		7.39%		3.63%		7.65%		34%

4. CONSIDERAÇÕES FINAIS

Este trabalho composto por três manuscritos, foi conduzido inicialmente conforme as relações filogenéticas moleculares das linhagens. O primeiro trata das linhagens em torno de *F. apiahyna*, o segundo das espécies que ocorrem em bambu e o terceiro engloba todo o restante, onde todas as outras espécies da linhagem neotropical ocorrentes no Brasil recebem tratamento taxonômico e/ou ampliação da área de ocorrência. Aqui foram propostas 13 novas espécies (*F. conyana, F. murrilli, F. melanoderma* ad int., *F. prolongata* ad int., *F. nubicola, F. puiggarii* ad int., *F. biformis* ad int., *F. pulvinata* ad int., *F. elliptica* ad int., *F. bambusipileata, F. rondoni* ad int., *F. exigua* ad int. e *F. rhizophila* ad int.), uma combinação nova (*F. elegans*) e dois registros de primeira ocorrência para o Brasil (*F. castilloi* e *F. impercepta*). Ou seja, o número de espécies do gênero foi ampliado de oito (*F. atlantica*, *F. apiahyna*, *F. bambusarum*, *F. maxonii*, *F. neotropica*, *F. sanctichampagnatii*, *F. spinescens* e *F. subtilissima*) para 23, com *F. punctata*, *F. robusta* e *F. dryophila* confirmadas como ausentes. Outro produto importante é a chave dicotômica construída para o Manuscrito III, ferramenta essa que será de grande valia para futuros trabalhos taxonômicos como também trabalhos de levantamento da Funga.

O principal padrão de diversidade do gênero consiste em espécies proximamente relacionadas com características morfológicas de difícil distinção, porém, podem ocorrer com preferências ecológicas claras (*e.g.* hospedeiros vivos exclusivos e/ou raízes mortas). Com isso, a obtenção dos dados ecológicos em campo deve ser uma das prioridades. Dados como hospedeiro e altitude são cruciais na diferenciação de algumas espécies. Assim, recomenda-se que toda coleta deva ter seu ponto georreferenciado e altitude anotada e quanto aos hospedeiros, fotografias das folhas (filotaxia e formato das folhas ajudam muito), frutos, flor e tronco devem ser realizadas, e na melhor realidade herborizados e/ou obtido material vegetativo fresco (que pode ser armazenado nos tubos *eppendorf* com CTAB, citado no Apêndice G) para extração de DNA.

Outra prioridade no estudo desse grupo são os dados moleculares, que junto aos dados morfológicos e ecológicos foram determinantes no entendimento das espécies. No entanto, algumas características dos basidiomas das espécies classificadas em Hymenochaetaceae costumam dificultar a obtenção de DNA com boa qualidade. Algumas dessas características são a presença de pigmentos e a rigidez por conta das hifas esqueletais de parede engrossada. Para contornar alguns desses desafios foram utilizados nitrogênio líquido para maceração e reagentes tóxicos para sua purificação, como β-mercaptoetanol e fenol. Porém com o intuito de utilizar processos mais simples e menos arriscados, foram testados e obtido sucesso com os procedimentos a seguir: obtenção de pedaços frescos da região ativa do basidioma (geralmente os tubos, mas também margens) em tampão CTAB já em campo e macerar pequenas quantidades (em torno de 1–2 mm^3) em tubo *eppendorf* com micro pistilo e prévio aquecimento à 60 °C, de 30–60 min em banho maria ou à seco (cuidando para os tubos não abrirem). No fim, foi possível eliminar o β-mercaptoetanol e o fenol, utilizando somente o clorofórmio: álcool isoamílico para as lavagens/purificação, de acordo com o protocolo no Apêndice G. No caso de basidiomas velhos e/ou materiais de herbários, utilizou-se os mesmos procedimentos citados acima, no entanto até a purificação com clorofórmio, a extração do DNA procedeu-se de modo fracionado, em 2–4 pedaços diferentes cada um em um tubo. Finalmente, no momento de adicionar o isopropanol somaram-se os volumes em um único tubo (de 100–150 µl de cada tubo), precipitando-se um único *pellet*.

A cultura micelial também pode facilitar a obtenção de DNA com boa qualidade. Porém há alguns desafios, como a recorrente contaminação. Quanto a isso, é necessário algum empenho em levar para campo tubos *eppendorf* com água sanitária e outros dois tubos com água destilada estéril para a descontaminação superficial dos pedaços ativos (última camada de tubos e/ou margem) dos basidiomas. Para manuseio dos pedaços a serem isolados, instrumentos como bisturis e pinças devem ser esterilizados com fogo e álcool, que podem ser um isqueiro e um borrifador. Na sequência, os pedaços de basidioma precisam de papel filtro estéril para diminuir a superfície de contaminação ao secá-los depois de retirar do segundo tubo de água destilada. E no fim, utilizar meio de cultura MEA 1,5% em tubos *eppendorf* de 1,5 mL, diminuindo assim a área de abertura do recipiente de cultura no momento do isolamento e que podem facilmente ser transferidos ao chegar no laboratório para placas de Petri.

De modo geral as espécies de *Fomitiporia* coletadas neste trabalho são difíceis de encontrar em campo. Com exceção de *F. impercepta* e *F. neotropica*, todas as outras espécies foram coletadas 2 a 3 vezes quando se retornou aos locais, porém o mais comum foram espécies que no total somaram uma coleta ou de uma a duas por local de coleta. Vale destacar a escassez daquelas que ocorrem em bambu, mesmo com grande esforço temporal em meio aos taquarais foi possível encontrar no máximo dois espécimes por espécie, como exemplo *F. bambusarum* e *F. bambusipileata* que puderam ser encontradas no mesmo fragmento predominante de *Merostachys multiramea*. Quanto ao período de coleta, como a maioria das espécies são perenes, os espécimes podem ser encontrados em todas as épocas do ano. Porém, o período chuvoso de cada região foi importante para encontrar os espécimes com a última camada ativa (esporulando).

O Brasil, um país de proporções continentais, apresenta dezenas de fitofisionomias e uma infinidade de nichos. Como foi observado com as espécies que ocorrem em bambu e *F. nubicola*—endêmica das florestas nebulares e das espécies de *Drimys* sp; o gênero, pode-se dizer que está pouco representado, com certeza muitas outras linhagens esperam por serem descobertas e trazidas a luz. A listar alguns taxa e regiões subamostradas, *F. rondoni* ad int. e *F. exigua* ad int., espécies do Cerrado e Amazônia, aparecem sozinhas, geneticamente distantes entre si, com basidiomas pileados entre as espécies ressupinadas, devem ser tratadas com atenção e a região onde ocorrem melhor entendida e conservada, visto que certamente há linhagens ainda por serem encontradas.

Os estudos das espécies de *Fomitiporia* que ocorrem no Brasil foi aqui ampliado. Como uma continuidade do mestrado realizado no PPG Biologia de Fungos, Algas e Plantas (UFSC), esse trabalho pôde confirmar o que os últimos trabalhos com o gênero vêm demonstrando. O gênero apresenta uma grande diversidade a ser descrita, alinhada em muitos casos com a especiação ecológica, a qual demonstra ser um direcionador evolutivo muito importante no reino Fungi como um todo. Dito isso, também é importante ressaltar que os outros gêneros da família também podem apresentar tal perfil evolutivo, e a meu ver o que impulsionou a descoberta e descrição das espécies de *Fomitiporia* na última década foi o estabelecimento das regiões do DNA que são informativas para o gênero, a partir disso, foi construído um banco de dados e foi possível com êxito realizar as comparações e entender as relações filogenéticas.

5. FINAL COMMENTS

This thesis is comprised of three manuscripts and was initially conducted based on the molecular phylogenetic relationships of the Neotropical lineages. The first manuscript analyses *F. apiahyna* s.lat., the second examines bambusicolous *Fomitiporia*, and the third deals with the remaining *Fomitiporia* lineages from Brazil, which receive taxonomic treatment and/or expansion of their geographic area of occurrence. Here were propose 13 new species (*F. conyana*, *F. murrilli*, *F. melanoderma* ad int., *F. prolongata* ad int., *F. nubicola*, *F. puiggarii* ad int., *F. biformis* ad int., *F. pulvinata* ad int., *F. elliptica* ad int., *F. bambusipileata*, *F. rondoni* ad int., *F. exigua* ad int. and *F. rhizophila* ad int.), one new combination (*F. elegans*), and two new records for Brazil (*F. castilloi* and *F. impercepta*). Therefore, the number of *Fomitiporia* species from Brazil has increased from eight (*F. atlantica*, *F. apiahyna*, *F. bambusarum*, *F. maxonii*, *F. neotropica*, *F. sanctichampagnatii*, *F. spinescens* and *F. subtilissima*) to 23, while *F. punctata*, *F. robusta*, and *F. dryophila* were confirmed as absent. Also, a dichotomous key is provided in Manuscript III, which will be important for future taxonomic studies of *Fomitiporia* and Funga surveys.

The main diversity pattern observed in *Fomitiporia* is that species are phylogenetically closely related, have poor morphological differentiation and may possess clear ecological preferences (e.g. exclusivity for living hosts and/or recurrence on dead roots). Thus, the collection of ecological data during field expeditions should be a priority. Data such as host type and altitude are crucial for species differentiation. In this study, I recommend that georeferenced points and the altitude should be recorded for each collection. Furthermore, regarding the host, pictures should be taken of the leaves (phyllotaxis is useful), fruits, flowers and the trunk. Ideally, host samples should be deposited in an herbarium and/or fresh vegetative material should be stored in CTAB, as suggested in the DNA extraction protocol in Appendix G.

Another priority of the *Fomitiporia* studies is the molecular data, which alongside the morphological and ecological data was crucial for the understanding of species delimitations. However, some basidiomata characteristics of Hymenochaetaceae species commonly complicate the acquisition of high-quality DNA. Some of these characteristics include the presence of pigments and hardness due to thick-walled skeletal hyphae. In order to get around some of these challenges, I have used liquid nitrogen to break hyphal walls and toxic reagents for purification, such as β-mercaptoethanol and phenol (hydroxybenzene). Since the aforementioned processes are complicated and considered health risks, I have successfully tested the following substitute DNA extraction procedure. Obtain fresh material from the active portion of the basidioma (usually the tube layers and/or margin) and immediately store in alkaline buffer (CTAB) in the field. Place small subsample (about 2 mm^3) in eppendorf tube, heat at 60 ºC for 30–60 min, and macerate using micropistils. Furthermore, purification was possible using Chloroform:Isoamyl Alcohol (24:1) following the protocol in Appendix G. For old basidiomata and herbarium specimens, I used the same above-mentioned procedure, but extracted the DNA of multiple subsamples in separate tubes up to the purification step. Then, in the DNA precipitation step, the samples were used together to form a single pellet.

Mycelium culture can also facilitate high-quality DNA acquisition. However, there are some challenges, such as constant contamination. In order to avoid contamination, tubes with sodium hypochlorite (SH) and sterilized water (SW) (two steps) can be brought to the field. The basidioma pieces can be handled with scalpel and forceps that are sterilized with fire and alcohol (e.g. using a lighter and a simple sprayer). After the SH and SW steps, I used sterilized filter paper to dry the sample and then put it in an eppendorf tube (1.5 mL) with 1.5% MEA. The small opening of this type of tube could decrease environmental exposure and make it easy to transfer the sample to a Petri dish in the laboratory even days after collection.

In general, the *Fomitiporia* species collected in this study were difficult to find. With the exception of *F. impercepta* and *F. neotropica*, I found 2–3 specimens per species in total when it was possible to return to the same site. Most commonly, however, I found one specimen per species, or a maximum of two. The bambusicolous species are scarce, where even temporal efforts of collection in bamboo forest patches, it was only possible to find a maximum of two specimens per species, such as for *F. bambusarum* and *F. bambusipileata*, which were found in the same *Merostachys multiramea*-predominant forest. Regarding the optimal collection period, since most of the *Fomitiporia* species are perennial, the specimens can be found yearlong. However, the rainy season in each region is important for finding the specimens with an active last tube layer (sporulation phase).

Brazil is a country of continental proportion that contains dozens of phytophysiognomies and tens of thousands of different niches. As was observed for bambusicolous species and *F. nubicola* (the latter is endemic to Cloud forests and found growing on *Drimys* trees), *Fomitiporia* has been poorly studied here. In my opinion, there are a lot of other undescribed species that pertain to this genus. For example, *F. rondoni* ad int. and *F. exigua* ad int. are species from the Cerrado and Amazon, respectively, that were recovered as a sister group and nested within a clade of resupinate species. Furthermore, they are genetically distant from each other and have highly distinct basidiomata characteristics. Thus, these species should be treated with care and the regions where they occur must be better studied and conserved, seeing as there are certainly lineages yet to be found.

This thesis increases the number of studies on *Fomitiporia* species that occur in Brazil. As a continuation of my Master's degree in PPG Biologia de Fungos, Algas e Plantas (UFSC), this study confirms the findings of the most recent studies of the genus. *Fomitiporia* has a high diversity of unknown species, mainly associated with ecological speciation, which appears to be an important evolutionary driving force in the Fungi kingdom. Furthermore, it is also important to note that the other genera in Hymenochaetaceae could present the same evolutionary profile as *Fomitiporia*. In my opinion, the discovery and description of a high number of *Fomitiporia* species in the last decade has been mainly driven by the establishment of informative DNA regions and a consistent database, allowing for the successful reconstruction of species phylogenetic relationships.

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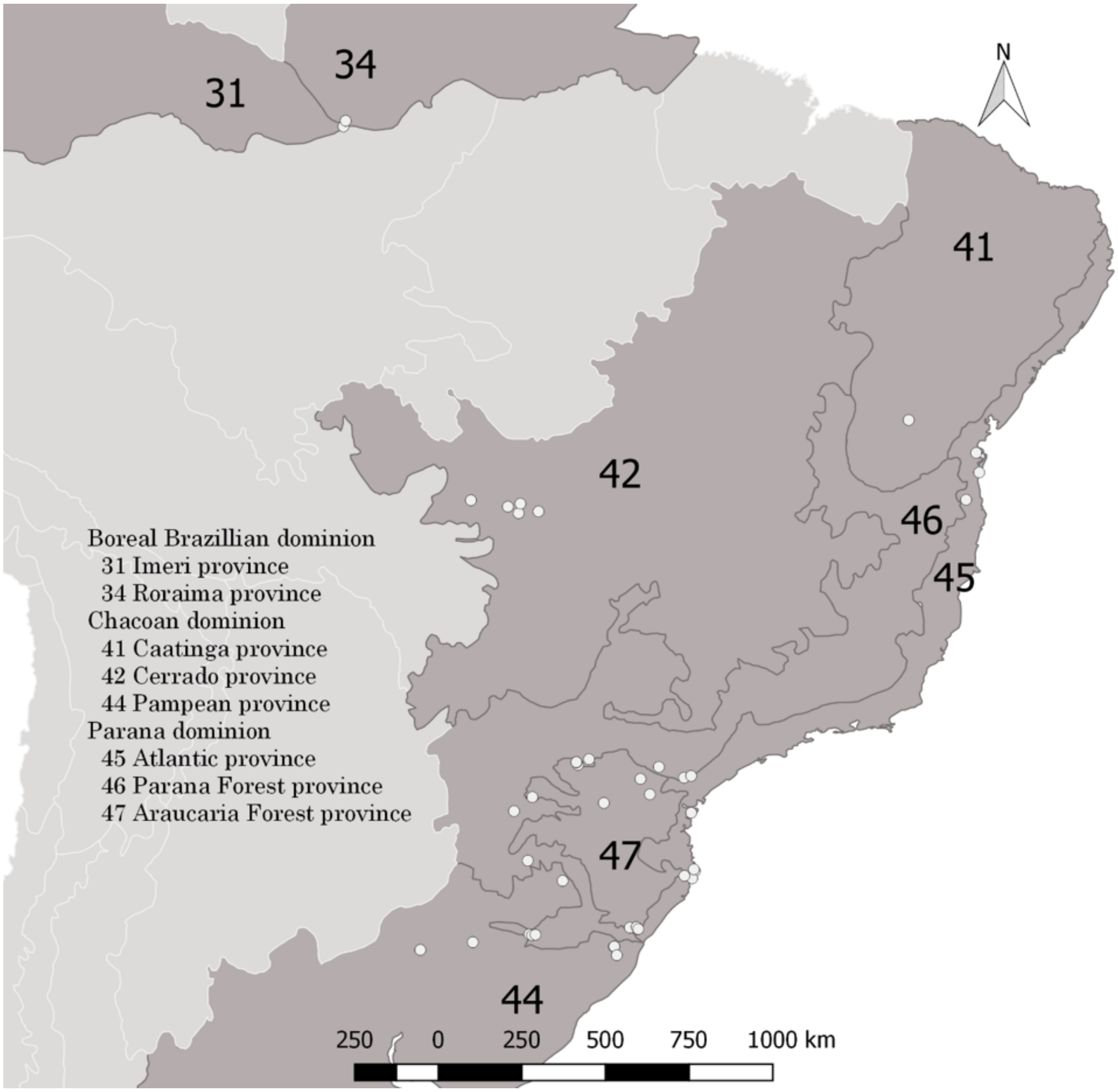
Apêndice A — Mapa das expedições de coleta



Apêndice A. Mapa com a distribuição dos pontos de coleta.

Apêndice B — Material revisado

Apêndice B. Listagem dos materiais analisados.

Herbário	N° tombo	Tipo	Molecular	Coletor	Número de coletor	Dia coleta	País	Estado	Município	Localidade	Coordenadas	Alt.	Hábitat
Fomitiporia apiahyna (Speg.) Robledo, Decock & Rajchenb.													
FLOR	58553		**sim**	E.R. Drechsler-Santos	1288	15/11/2013	Brasil	SC	Santo Amaro da Imperatriz	Trilha hotel Caldas da Imperatriz	27°44'04.11"S 48°48'21.44"W		sobre toco morto
ICN	200542		**sim**	Alves-Silva, G.	1270	06/02/2018	Brasil	SP	Apiaí	Parque Natural Municipal Morro do Ouro	24º31'18.9"S 48º50'04.7"W	840m	sobre árvore morta em pé (*Ocotea* sp.)
ICN	200543		**sim**	Alves-Silva, G.	1311	09/02/2018	Brasil	SP	Apiaí	Parque Natural Municipal Morro do Ouro	24º31'18.6"S 48º50'04.3"W	899m	na base de *Ocotea* sp. viva
ICN	200544		**sim**	V. Oliveira-Garcia	111	22/02/2017	Brasil	PR	Guarapuava	Parque Municipal das Araucárias	25º21'10"S 51º28'13"W	1070m	sobre árvore morta em pé
ICN	200545		**sim**	Alves-Silva, G.	977	26/11/2016	Brasil	RS	São Francisco de Paula	Floresta Nacional de São Francisco de Paula			na base de árvore viva em pé (Myrtaceae)
ICN	200546		**sim**	Alves-Silva, G.	979	26/11/2016	Brasil	RS	São Francisco de Paula	Floresta Nacional de São Francisco de Paula		913m	sobre raízes de árvore morta caída
ICN	200547		**sim**	V. Oliveira-Garcia	158	25/06/2017	Brasil	RS	São Francisco de Paula	Hotel Veraneio Hampel	29º26'38"S 50º36'50"W	900m	sobre árvore morta em pé
ICN			**sim**	Alves-Silva, G.	1155	19/06/2017	Brasil	RS	São Francisco de Paula	Hotel Parque Veraneio Hampel			sobre árvore morta em pé
LPS	24922	**T**		J. I. Puiggari	1438		Brasil	SP	Apiaí				sobre tronco morto velho
Fomitiporia atlantica Alves-Silva, Reck & Drechsler-Santos													
FLOR	58554	**T**	**sim**	Alves-Silva, G.	640	21/11/2014	Brasil	SC	Blumenau	Parque Natural Municipal São Francisco de Assis	26°55'17"S 49°04'19"W		sobre toco morto
FURB	47591	**PT**	**sim**	F. Bittencourt	507	15/09/2015	Brasil	SC	Blumenau	Parque Natural Municipal São Francisco de Assis	26°55'17"S 49°04'19"W		sobre toco morto
FURB	48931			F. Bittencourt	687	19/01/2016	Brasil	SC	Blumenau	Parque Natural Municipal São Francisco de Assis	26°55'17"S 49°04'19"W		sobre árvore morta
FURB	51308			F. Bittencourt	724	27/01/2016	Brasil	SC	Blumenau	Parque Natural Municipal São Francisco de Assis	26°55'17"S 49°04'19"W		
FURB	51342			F. Bittencourt	763	28/01/2016	Brasil	SC	Blumenau	Parque Natural Municipal São Francisco de Assis	26°55'17"S 49°04'19"W		
PACA	20957			Rick, J.		21/04/1944	Brasil	RS	Montenegro	São Salvador			
Fomitiporia bambusarum (Rick) Camp.-Sant. & Decock													
FLOR	11263			Gerber	735	26/07/1995	Brasil	SC	Florianópolis	Morro da Lagoa			sobre colmo de bambu morto
FLOR	11434			A. Muger		27/06/1989	Brasil	PR	General Carneiro				sobre colmo de bambu morto
FLOR	31663			Michels		17/01/2005	Brasil	SC	Águas Mornas	Parque Estadual Serra do Tabuleiro			sobre colmo de bambu morto
FLOR	31665			Michels	240	17/01/2005	Brasil	SC	Águas Mornas	Parque Estadual Serra do Tabuleiro			sobre colmo de bambu morto
FLOR	31759			Michels	415	18/01/2005	Brasil	SC	Águas Mornas	Parque Estadual Serra do Tabuleiro			sobre colmo de bambu morto
FLOR	31851			Michels	288	18/01/2005	Brasil	SC	Águas Mornas	Parque Estadual Serra do Tabuleiro			sobre colmo de bambu morto
ICN	139046			A. de Meijer	2448	06/02/1993	Brasil	PR	Piraquara	Parque Estadual Pico do Morumbi			sobre bambu morto (*Guadua* sp.)
ICN	139047			G. Coelho	382-7	26/03/2003	Brasil	RS	Santa Maria	FEPAGRO			sobre colmo de bambu morto (*Bambusa tuldoides*)
ICN	139048			G. Coelho		20/05/2005	Brasil	RS	Dom Pedro de Alcântara	Reserva Particular do Patrimônio Natural Prof Luis Batista			sobre colmo de bambu morto (*Merostachys multiramea*)
ICN	139049			G. Coelho		10/06/2005	Brasil	RS	São Francisco de Paula	Pró-Mata, Trilha Três Forquilhas			sobre colmo de bambu morto (*Merostachys multiramea*)
ICN	139050			G. Coelho		11/06/2005	Brasil	RS	São Francisco de Paula	Pró-Mata, Trilha Três Forquilhas			sobre colmo de bambu morto (*Merostachys multiramea*)
ICN	154305			M.C. Westphalen	179	24/04/2009	Brasil	RS	São Francisco de Paula	Floresta Nacional de São Francisco de Paula			sobre colmo de bambu morto
ICN	154306			M.C. Westphalen	217	29/05/2009	Brasil	RS	São Francisco de Paula	Pró-Mata			sobre colmo de bambu morto
ICN	154372			M.C. Westphalen	264	26/09/2009	Brasil	RS	São Francisco de Paula	Pró-Mata			sobre colmo de bambu morto
ICN	178783			M. Campos-Santana	2	12/03/2010	Brasil	RS	Dom Pedro de Alcântara	Reserva Particular do Patrimônio Natural Prof Luis Batista	29°22'10"S 49°50'59"W	37m	sobre colmo de bambu morto
ICN	178789			M. Campos-Santana	14	12/03/2010	Brasil	RS	Dom Pedro de Alcântara	Reserva Particular do Patrimônio Natural Prof Luis Batista	29°22'10"S 49°50'59"W	37m	sobre colmo de bambu morto
ICN	178797			M. Campos-Santana	26	13/03/2010	Brasil	RS	Mourrinhos do Sul	Lageadinho	29°21'54"S 49°56'05"W		sobre colmo de bambu morto
ICN	178798			M. Campos-Santana	28	13/03/2010	Brasil	RS	Mourrinhos do Sul	Lageadinho	29°21'54"S 49°56'05"W		sobre colmo de bambu morto
ICN	178799			M. Campos-Santana	29	13/03/2010	Brasil	RS	Mourrinhos do Sul	Lageadinho	29°21'54"S 49°56'05"W		sobre colmo de bambu morto
ICN	178933			M. Campos-Santana	378	12/11/2010	Brasil	PR	Piraquara	Morro do Canal			sobre colmo de bambu morto
ICN	178940			M. Campos-Santana	394	12/11/2010	Brasil	PR	Piraquara	Morro do Canal			sobre colmo de bambu morto
ICN	178941			M. Campos-Santana	395	12/11/2010	Brasil	PR	Piraquara	Morro do Canal			sobre colmo de bambu morto
ICN	179059			M. Campos-Santana	630	13/08/2011	Brasil	RS	Dom Pedro de Alcântara	Reserva Particular do Patrimônio Natural Prof Luis Batista	29°22'10"S 49°50'59"W	37m	sobre colmo de bambu morto
ICN	179062			M. Campos-Santana	633	13/08/2011	Brasil	RS	Dom Pedro de Alcântara	Reserva Particular do Patrimônio Natural Prof Luis Batista	29°22'10"S 49°50'59"W	37m	sobre colmo de bambu morto
ICN	179065			M. Campos-Santana	637	13/08/2011	Brasil	RS	Dom Pedro de Alcântara	Reserva Particular do Patrimônio Natural Prof Luis Batista	29°22'10"S 49°50'59"W	37m	sobre colmo de bambu morto
ICN	200562		**sim**	Alves-Silva, G.	1213	29/10/2017	Brasil	RS	Derrubadas	Parque Estadual do Turvo			sobre colmo de bambu morto (*Merostachys multiramea*)
ICN	200563		**sim**	Alves-Silva, G.	1227	30/10/2017	Brasil	RS	Derrubadas	Parque Estadual do Turvo			sobre colmo de bambu morto pé (*Merostachys multiramea*)
ICN	200564		**sim**	Alves-Silva, G.	1232	31/10/2017	Brasil	RS	Sarandi	Parque Estadual Papagaio Charão	27º54'41.5"S 52º49'11.1"W		sobre colmo de bambu morto pé (*Merostachys multiramea*)
ICN	200569			Reck, M.A.	748	04/09/2013	Brasil	PR	Piraquara	Morro do Canal			sobre colmo de bambu morto
INPA	100134			B. Lowy	B277BR	27/09/1980	Brasil	AC	Rio Branco	km 25 from Rio Branco to Porto Acre			sobre colmo de bambu morto
PACA	13938			Rick, J.	6438			RS	Salvador do Sul	S. Salvador			sobre colmo de bambu morto
PACA	18570	**T**		Rick, J.	8683			RS	São Leopoldo				sobre colmo de bambu morto
SP	446263			R.M. Pires	50	11/06/2013	Brasil	SP	São Luiz do Paraitinga	Parque Estadual Serra do Mar, Núcleo Santa Virgínia	23°26'15"S 45°14'23"W		sobre colmo de bambu morto

Herbário	N° tombo	Tipo	Molecular	Coletor	Número de coletor	Dia coleta	País	Estado	Município	Localidade	Coordenadas	Alt.	Hábitat
Fomitiporia bambusipileata **sp. nov.** Alves-Silva, Drechsler-Santos & R.M. Silveira													
ICN	200557	**T**	**sim**	Alves-Silva, G.	1070	25/02/2017	Brasil	PR	Campo Mourão	Parque Estadual do Lago Azul	24º06'15.2"S 52º18'30.1"W		na base de colmos mortos em pé (*Merostachys* sp.)
ICN	200558			Alves-Silva, G.	1217	29/10/2017	Brasil	RS	Derrubadas	Parque Estadual do Turvo	27º14'15.1"S 53º58'38.3"W		sobre colmo de bambu morto pé (*Merostachys multiramea*)
ICN	200559		**sim**	Alves-Silva, G.	1219	29/10/2017	Brasil	RS	Derrubadas	Parque Estadual do Turvo			sobre colmo de bambu morto pé (*Merostachys multiramea*)
ICN	200560		**sim**	Alves-Silva, G.	1221	29/10/2017	Brasil	RS	Derrubadas	Parque Estadual do Turvo			sobre colmo de bambu morto caído (*Merostachys multiramea*)
Fomitiporia biformis ad int. **sp. nov.** Alves-Silva, R.M. Silveira & Drechsler-Santos													
ICN	178860			M. Campos-Santana	192	07/06/2010	Brasil	RS	São Francisco de Paula	Floresta Nacional de São Francisco de Paula	29°25'22.4"S 50°23'11.2"W		sobre árvore morta
ICN			**sim**	V. Oliveira-Garcia	159	25/06/2017	Brasil	RS	São Francisco de Paula	Hotel Veraneio Hampel		900m	sobre árvore morta em pé
ICN			**sim**	Alves-Silva, G.	669	13/12/2014	Brasil	SP	Apiaí	Parque Natural Municipal Morro do Ouro			sobre toco morto
ICN			**sim**	Alves-Silva, G.	811	23/05/2016	Brasil	RS	São Francisco de Paula	Hotel Veraneio Hampel		900m	sobre árvore morta em pé
ICN			**sim**	Alves-Silva, G.	826	11/06/2016	Brasil	RS	São Francisco de Paula	Floresta Nacional São Francisco de Paula		900m	sobre toco morto
ICN			**sim**	Alves-Silva, G.	890	18/09/2016	Brasil	BA	Camacã	RPPN Serra Bonita, Trilha torre	15º23'14.0"S 39º33'50.9"W	900m	sobre árvore viva, parte morta
ICN			**sim**	Alves-Silva, G.	891	18/09/2016	Brasil	BA	Camacã	RPPN Serra Bonita, Trilha torre			na parte de baixo, árvore caída
ICN		**T**	**sim**	Alves-Silva, G.	980	26/11/2016	Brasil	RS	São Francisco de Paula	Floresta Nacional de São Francisco de Paula		913m	sobre toco morto
ICN			**sim**	Alves-Silva, G.	978	26/11/2016	Brasil	RS	São Francisco de Paula	Floresta Nacional de São Francisco de Paula	29°25'18.6"S 50°23'24.7"W	913m	sobre árvore morta em pé
ICN			**sim**	Alves-Silva, G.	1283	07/02/2018	Brasil	SP	Apiaí	Parque Natural Municipal Morro do Ouro	24°30'44.5"S 48°49'04.0"W	970m	sobre tronco morto caído, supenso
ICN				E.P. Fazolino	677		Brasil	RS	São Francisco de Paula	Floresta Nacional São Francisco de Paula			
Fomitiporia castilloi Decock & Amalfi													
INPA	19425			G.T. Prance		21/12/1966	Brasil	AM	Itacoatiara	Itacoatiara highway, Rio Urubú, Km206			
Fomitiporia conyana **sp. nov.** Alves-Silva & Drechsler-Santos													
FLOR	58546		**sim**	Alves-Silva, G.	737	10/02/2014	Brasil	MT	Primavera do Leste	Córrego Alminhas, IMAmt, Mata de galeria	15°31'17.16"S 54°12'23.31"W		sobre árvore morta em pé
FLOR	58547		**sim**	Alves-Silva, G.	742	10/02/2014	Brasil	MT	Primavera do Leste	Córrego Alminhas, IMAmt, Mata de galeria	15°31'17.16"S 54°12'23.31"W		sobre árvore morta em pé
FLOR	58548	**T**	**sim**	Alves-Silva, G.	738	12/11/2013	Brasil	MT	Primavera do Leste	Córrego Alminhas, IMAmt, Mata de galeria	15°31'17.16"S 54°12'23.31"W		sobre árvore morta em pé
FLOR	58549		**sim**	D. Batistella	2-21	11/03/2015	Brasil	MT	Novo Mundo	Parque Estadual Cristalino, Parcelas PPBio	9°30'49.04"S 55°39'25.75"W		
FLOR	58563		**sim**	Alves-Silva, G.	559	22/12/2013	Brasil	MT	Primavera do Leste	Córrego Alminhas, IMAmt, Mata de galeria	15°31'17.16"S 54°12'23.31"W		sobre árvore morta em pé
FLOR	31845			Michels, J.	575	16/05/2005	Brasil	SC	Palhoça				
FLOR	48516			C.A. Salvador-Montoya	148	20/03/2010	Peru	Cusco	Quincemil		13º12'57"S 70º43'17"W	795m	sobre árvore viva
FURB	45529			F. Bittencourt	387	14/08/2014	Brasil	SC	Blumenau	Parque Natural Municipal São Francisco de Assis	26°55'17.4"S 49°04'18.62"W		sobre árvore morta
FURB	47565			F. Bittencourt	501	29/07/2015	Brasil	SC	Blumenau	Parque Natural Municipal São Francisco de Assis			
FURB	47595		**sim**	F. Bittencourt	511	15/09/2015	Brasil	SC	Blumenau	Parque Natural Municipal São Francisco de Assis	26°55'17"S 49°04'18"W		na base de árvore viva
FURB	52826			F. Bittencourt	863	17/09/2016	Brasil	SC	Blumenau	Reserva Particular do Patrimônio Natural	27°00'11"S 49°04'23"W		sobre árvore viva
HUEFS	61517			Dias, J.L.A.	3	13/11/2002	Brasil	BA	Santa Teresinha	Serra da Jiboia	12°51'00.0"S 39°28'00.0"W		
HUEFS	132193			Paraiso, N.		14/04/2007	Brasil	BA	Santa Teresinha	Serra da Jiboia			
HUEFS	132285			Góes-Neto, A.	98		Brasil	BA	Santa Teresinha	Serra da Jiboia			sobre tronco de árvore
ICN	200548		**sim**	Alves-Silva, G.	998	27/12/2016	Brasil	MT	Cuiabá	Parque Nacional Chapada dos Guimarães, Sítio Véu de Noiva			Na base de árvore viva
ICN	200549			Alves-Silva, G.	1007	27/12/2016	Brasil	MT	Cuiabá	Parque Nacional Chapada dos Guimarães, Sítio Véu de Noiva			Na base de árvore morta
ICN	200550			Alves-Silva, G.	1025	29/12/2016	Brasil	MT	Primavera do Leste	Córrego Alminhas, IMAmt, Mata de galeria			Na base de árvore viva
ICN	200551		**sim**	Alves-Silva, G.	972	21/10/2016	Brasil	RS	Porto Alegre	Morro Santana			sobre árvore morta em pé
ICN	200552		**sim**	M. Comin	60	21/09/2016	Brasil	BA	Igrapiuna	Reserva Ecologica Michellin		324m	sobre tronco morto caído
ICN				Alves-Silva, G.	1005	27/12/2016	Brasil	MT	Cuiabá	Parque Nacional Chapada dos Guimarães, Sítio Véu de Noiva			Na base de árvore viva
ICN			**sim**	Alves-Silva, G.	1008	27/12/2016	Brasil	MT	Cuiabá	Parque Nacional Chapada dos Guimarães, Sítio Véu de Noiva			Na base de árvore viva
Fomitiporia elegans **comb. nov.** (J.E. Wright & Blumenf.) Alves-Silva, Robledo & Drechsler-Santos													
BAFC	24382	**T**				27/10/1973	Argentina	Misiones		Parque Nacional Iguazú, Cataratas			sobre *Ocotea* sp.
FLOR	58556		**sim**	Alves-Silva, G.	642	21/11/2014	Brasil	SC	Blumenau	Parque Nacional Serra do Itajaí, Trilha da chuva	27°03'34.25"S 49°04'57.22"W		sobre árvore morta em pé
FLOR	58570			A.G.S. Silva-Filho	56	02/02/2013	Brasil	SC	Tubarão	Rio do Pouso Alto, Fazenda Lunard, Trilha do rio	28°22'21.4"S 49°05'57.5"W		
FURB	44484		**sim**	F. Bittencourt	157	14/08/2014	Brasil	SC	Blumenau	Parque Natural Municipal São Francisco de Assis	26º55'17.4"S 49º04'18.62"W		sobre árvore morta
Fomitiporia elliptica ad int. **sp. nov.** Alves-Silva & Drechsler-Santos													
ICN			**sim**	Alves-Silva, G.	923	21/09/2016	Brasil	BA	Igrapiúna	Reserva Ecológica da Michelin	13º50'59.8"S 39º13'44.3"W		sobre árvore morta em pé
ICN		**T**	**sim**	E.R. Drechsler-Santos	1737	25/04/2015	Brasil	SC	Florianópolis	Parque Municipcal Córrego Grande, trilha do pau jacaré			sobre árvore morta em pé (Melia azedarach)
FLOR	58567		**sim**	Batistella, D.	3-31	11/03/2015	Brasil	MT	Novo Mundo	Parque Estadual Cristalino, parcelas PPBio			
Fomitiporia exigua ad int. **sp. nov.** Alves-Silva, R.M. Silveira & Drechsler-Santos													
FLOR	58558	**T**	**sim**	E.R. Drechsler-Santos	1256	06/12/2013	Brasil	AM	Novo Airão	PN Anavilhanas, Igarapé Santo Antônio	2°24'42.5"S 60°58'08.9"W		sobre árvore viva (*Protium heptaphyllum* (Aubl.) Marchand)
Fomitiporia hippophaeicola (H. Jahn) Fiasson & Niemelä													
SP	141694			I. Nordin		07/10/1967	Sweden	Uppsala	Vänge	"Fiby urskog"			sobre *Hippophae rhamnoides*
SP	141696			I. Nordin		07/10/1967	Sweden	Uppsala	Vänge	"Fiby urskog"			sobre *Hippophae rhamnoides*

Herbário	N° tombo	Tipo	Molecular	Coletor	Número de coletor	Dia coleta	País	Estado	Município	Localidade	Coordenadas	Alt.	Hábitat
Fomitiporia impercepta Morera, Robledo & Urcelay													
FLOR	31655			Michels	222	17/12/2004	Brasil	SC	São Bonifácio				sobre galho morto em árvore viva
FLOR	31691			Michels		18/01/2005	Brasil	SC	Águas Mornas				
FLOR	32228			M. Campos-Santana	31	03/01/2006	Brasil	SC	Mondaí	Linha Sanga Forte			sobre árvore morta (*Nectandra membranaceae*)
FLOR	32229			M. Campos-Santana	292	25/05/2007	Brasil	SC	Mondaí	Linha Uruguai			sobre árvore morta
FLOR	51646			R. Fagundez-Fernandez	119	26/10/2013	Brasil	SC	Águas Mornas	Reserva Particular do Pratrimônio Natural Sítio Portal		900m	
FLOR	58561		**sim**	S. Galvão-Elias		15/09/2015	Brasil	SC	Florianópolis	Morro da Lagoa, CASAN			
FLOR	58568		**sim**	G. Alves-Silva	712	22/12/2014	Brasil	SC	Concórdia	Parque Estadual Fritz Plaumann, trilha do mirante			
FLOR	58569		**sim**	G. Alves-Silva	661	04/12/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Parcela das Dicksonia sp.			sobre galho no solo
ICN	154128			M.C. Westphalen	76	14/12/2007	Brasil	RS	Porto Alegre	Morro Santana			sobre galho morto
ICN	154308			M.C. Westphalen	161	24/04/2009	Brasil	RS	São Francisco de Paula	Floresta Nacional de São Francisco de Paula			
ICN	178810			M. Campos-Santana	57	06/05/2013	Brasil	RS	São Francisco de Paula	Veraneio Hampel	29°26'52"S 50°35'02"W		sobre árvore morta
ICN	178954			M. Campos-Santana	434	10/12/2010	Brasil	SC	Mondaí	Linha Uruguai	27°06'16"S 53°24'07"W	235m	sobre árvore morta
ICN	178955			M. Campos-Santana	435	10/12/2010	Brasil	SC	Mondaí	Linha Uruguai	27°06'16"S 53°24'07"W	235m	sobre árvore morta
ICN				A.G.S. Silva-Filho	88	23/03/2014	Brasil	SC	Tubarão				
ICN				C. Salvador-Montoya	560	23/02/2014	Brasil	BA	Salvador	Pousada Parate			sobre árvore viva (*Inga* sp.)
ICN				C. Salvador-Montoya	800	23/03/2017	Argentina	Misiones	Puerto Iguazú	Parque Nacional de Iguazú			sobre galho morto
ICN				E.R. Drechsler-Santos	729	21/12/2011	Brasil	SC	Concórdia	Parque Estadual Fritz Plaumann, Trilha da canafístula			sobre galho no solo
ICN				E.R. Drechsler-Santos	752	21/12/2011	Brasil	SC	Concórdia	Parque Estadual Fritz Plaumann, Trilha do Lajeado Cruzeiro			sobre árvore viva
ICN				E.R. Drechsler-Santos	933	16/02/2013	Brasil	SC	Urubici	Parque Nacional São Joaquim			sobre galho no solo
ICN				E.R. Drechsler-Santos	1315	16/02/2014	Brasil	SC	Florianópolis	Laoga do Peri, Trilha do Saquinho			na parte morta de árvore viva (Sebastiana cf. comercionana)
ICN				E.R. Drechsler-Santos	1319	16/02/2014	Brasil	SC	Florianópolis	Laoga do Peri, Trilha do Saquinho			sobre galho morto em árvore viva
ICN				G. Alves-Silva	626	28/09/2014	Brasil	SC	Joaçaba	Parque Ecológico Municipal Rio do Peixe			sobre galho morto suspenso contanto c/ solo
ICN				G. Alves-Silva	700	22/12/2014	Brasil	SC	Concórdia	Parque Estadual Fritz Plaumann, Trilha da Canafístula			sobre árvore morta em pé (*Peltophorum dubium*)
ICN				G. Alves-Silva	812	23/05/2016	Brasil	RS	São Francisco de Paula	house near to Hotel Parador Hampel			sobre toco morto
ICN				G. Alves-Silva	970	21/10/2016	Brasil	RS	Porto Alegre	Morro Santana			sobre árvore viva
ICN				G. Alves-Silva	1114	21/04/2017	Brasil	RS	Viamão	Parque Estadual de Itapuã			sobre galho morto
ICN				G. Alves-Silva	1115	21/04/2017	Brasil	RS	Viamão	Parque Estadual de Itapuã			sobre galho de árvore morta em pé
ICN				G. Alves-Silva	1117	21/04/2017	Brasil	RS	Viamão	Parque Estadual de Itapuã			sobre galho morto suspenso
ICN				G. Alves-Silva	1183	30/07/2017	Brasil	RS	Barra do Quaraí	Parque Estadual do Espinilho	30°10'26.6"S 57°31'10.5"W		sobre galho morto em árvore viva
ICN				G. Alves-Silva	1226	30/10/2017	Brasil	RS	Derrubadas	Parque Estadual do Turvo			sobre árvore morta inclinada
ICN				G. Alves-Silva	1230	31/10/2017	Brasil	RS	Sarandi	Parque Estadual Papagaio Charão	27°54'28,8"S 52°49'21,0"W		sobre árvore viva
ICN				G. Alves-Silva	240	05/08/2012	Brasil	MT	Chapada dos Guimarães	Parque Nacional Chapada dos Guimarães, Sítio Véu de Noiva	15°24'25.5"S 55°50'09.3"W		sobre galho morto suspenso
ICN				M.A. Reck	1288	11/02/2016	Brasil	SC	Florianópolis	Parque Municipal do Córrego Grande			
ICN				M.P. Palacio	284	08/12/2017	Brasil	RS	Muitos Capões	Estação Ecológica de Aracurí			
ICN				V. Oliveira-Garcia	204	11/11/2017	Brasil	RS	Guaíba	Fazenda São Maximiano	30°10'47"S 51°23'33"W	198m	sobre árvore viva
ICN				G. Alves-Silva	1037	22/02/2017	Brasil	PR	Guarapuava	Parque Municipal das Araucárias			sobre árvore viva
ICN				M. Palacio	189	16/01/2017	Brasil	SC	Santo Amaro da Imperatriz	Parque Estadual Serra do Tabuleiro			sobre galho morto
ICN				S. C. Feuerstein		17/05/2018	Brasil	RS	São Francisco de Paula	Pró-Mata			sobre árvore morta
SP	141724			V.L. Penteado		30/08/1977	Brasil	SP	Cananéia	Ilha do Cardoso, caminho da cachoeira			sobre árvore morta
SP	141725			V.L. Penteado		30/08/1977	Brasil	SP	Cananéia	Ilha do Cardoso, caminho da cachoeira			sobre árvore morta
SP	156809			R.A. Píccolo		21/09/1978	Brasil	SP	Mogi-Guaçu	Fazenda Campininha			sobre árvore morta
SP	157407			V.L. Bononi		22/07/1981	Brasil	SP	Cananéia	Ilha do Cardoso, near to R. Tapera			sobre árvore morta
SP	211913			M.A. de Jesus		30/07/1985	Brasil	SP	São Paulo	Parque Estadual das Fontes do Ipiranga			sobre árvore morta
SP	307274			A.M. Gugliotta	942	10/07/1997	Brasil	SP	Itapecerica da Serra				sobre galho no solo
Fomitiporia langloisii Murrill													
SP	141503			W.B. & V.G. Cooke	41762	18/10/1969	USA	OHIO	Ross County	Scioto Trails State Forest			sobre *Sassafras varrifolium*
Fomitiporia maxonii Murrill													
INPA	278267		**sim**	Alves-Silva, G.	1178	13/07/2017	Brasil	AM	Manaus	Praça da saudade			sobre galho morto de árvore
Fomitiporia melanoderma ad int. **sp. nov.** Alves-Silva, R.M. Silveira & Drechsler-Santos													
ICN			**sim**	Alves-Silva, G.	893	18/09/2016	Brasil	BA	Camacã	RPPN Serra Bonita, Tower trail	15°23'14.0"S 39°33'50.9"W		sobre árvore morta em pé
Fomitiporia murrilli **sp. nov.** Alves-Silva, R.M. Silveira & Drechsler-Santos													
ICN	200553	**T**	**sim**	Alves-Silva, G.	1199	01/08/2017	Brasil	RS	Santa Maria	FEPAGRO	29º39'47.1"S 53º54'52.2"W		na base de árvore viva (*Eucalyptus* sp.)
ICN	200554			Alves-Silva, G.	1333	08/09/2018	Brasil	RS	Porto Alegre	Jardim Botânico de Porto Alegre			sobre *Eucalyptus* sp. vivo
ICN	200555		**sim**	V. Oliveira-Garcia	99	27/01/2017	Brasil	RS	Porto Alegre	Jardim Botânico de Porto Alegre	30º3'1.9"S 51º10'34.6"W		sobre árvore morta em pé
ICN	200556		**sim**	V. Oliveira-Garcia	100	27/01/2017	Brasil	RS	Porto Alegre	Jardim Botânico de Porto Alegre	30º3'1.9"S 51º10'34.6"W		sobre árvore morta em pé

Herbário	N° tombo		Tipo	Molecular	Coletor	Número de coletor	Dia coleta	País	Estado	Município	Localidade	Coordenadas	Alt.
Fomitiporia neotropica Camp.-Sant., Amalfi, R.M. Silveira, Robledo & Decock													
FLOR	10584			C. Loguercio-Leite	142	24/02/1988	Brasil	SC	Florianópolis	Morro da Lagoa da Conceição (CASAN)			sobre árvore morta
FLOR	10634			C. Loguercio-Leite	252	26/07/1988	Brasil	SC	Florianópolis	Morro da Lagoa da Conceição (CASAN)			sobre galho morto
FLOR	10905			Z. Willerding	276	11/08/1993	Brasil	SC	Major Gercino			40m	sobre árvore morta
FLOR	11188			Gerber	674	30/05/1995	Brasil	SC	Florianópolis	Morro da Lagoa da Conceição (CASAN)			sobre tronco de árvore caído
FLOR	11306			Gerber	673	30/05/1995	Brasil	SC	Florianópolis	Morro da Lagoa da Conceição (CASAN)			sobre galho morto
FLOR	31585			Michels	84	04/09/2004	Brasil	SC	Paulo Lopes				
FLOR	31613			Michels	147	10/10/2004	Brasil	SC	Paulo Lopes				
FLOR	31734			Michels	372	20/01/2005	Brasil	SC	Imaruí				
FLOR	51128			V. Ferreira-Lopes	62	16/01/2012	Brasil	SC	Florianópolis	Morro da Lagoa da Conceição	27°33'38"S 48°27'13"W		.
FLOR	58560		**sim**	G. Alves-Silva	752	15/09/2015	Brasil	SC	Florianópolis	Morro da Lagoa da Conceição (CASAN)	27°35'09"S 48°28'37"W		sobre galho no solo
FLOR	58562		**sim**	M.A. Reck	817	23/11/2014	Brasil	RJ	Rio de Janeiro	Parque Nacional da Tijuca			sobre galho morto
FLOR	58565		**sim**	C. Salvador-Montoya	557	06/12/2013	Brasil	SC	Florianópolis	UFSC, near to RU			sobre galho morto em árvore viva
FLOR	58567			D. Batistella	31	11/03/2015	Brasil	MT	Novo Mundo	Parque Estadual Cristalino	9°30'49"S 55°39'26"W		sobre galho morto em árvore viva
ICN	154374			M.C. Westphalen	270	26/09/2009	Brasil	RS	São Francisco de Paula	Floresta Nacional de São Francisco de Paula			sobre galho morto
ICN	178910			M. Campos-Santana	319	16/10/2010	Brasil	RS	Viamão	Parque Estadual de Itapuã			sobre árvore morta
ICN	179029			M. Campos-Santana	558	21/05/2011	Brasil	RS	São Francisco de Paula	Floresta Nacional de São Francisco de Paula	29°25'22.4"S 50°23'11.2"W		sobre árvore morta
ICN	179037			M. Campos-Santana	572	22/05/2011	Brasil	RS	São Francisco de Paula	Floresta Nacional de São Francisco de Paula	29°25'22.4"S 50°23'11.2"W		sobre árvore morta
ICN	179051			M. Campos-Santana	607	31/05/2011	Brasil	RS	Porto Alegre	Refúgio da Vida Silvestre - UFRGS	30°03'S 51°07'W	130m	sobre árvore morta
ICN	179082			M. Campos-Santana	671	29/04/2013	Brasil	SC	Itapoá	Reserva Particular do Pratrimônio Natural Volta Velha	26°07'01"S 48°36'58"W		sobre árvore morta
ICN	190598	**PT**		M. Campos-Santana	30	13/03/2010	Brasil	RS	Morrinhos do Sul	Lajeadinho			sobre árvore morta
ICN	190599	**PT**		M. Campos-Santana	253	02/10/2010	Brasil	SC	Florianópolis	Unidade de Conservação Ambiental Desterro - UCAD			sobre galho morto
ICN	190600	**PT**		M. Campos-Santana	319	16/10/2010	Brasil	RS	Viamão	Parque Estadual de Itapuã			sobre galho morto
ICN	190601	**PT**		M. Campos-Santana		16/08/2011	Brasil	RS	Porto Alegre	Refúgio da Vida Silvestre - UFRGS			sobre galho morto
ICN				A.C. Magnado	913	26/01/2014	Brasil	PR	Piraquara	Morro do Canal			sobre árvore morta
ICN				C. Salvador-Montoya	505	04/12/2012	Brasil	ES	Santa Teresa	Reserva Biológica Augusto Ruschi			sobre árvore morta inclinada
ICN				C. Salvador-Montoya	540	01/06/2013	Brasil	SC	Florianópolis	Universidade Federal de Santa Catarina			sobre arbusto vivo (*Lagerstroemia indica*)
ICN				C. Salvador-Montoya	555	01/12/2013	Brasil	SC	Florianópolis	Universidade Federal de Santa Catarina			sobre galho morto em árvore viva
ICN				CALD	9	02/03/2011	Brasil	SC	Palhoça	Parque Estadual Serra do Tabuleiro, Baixada do Maciambu	27°50'41.4"S 48°37'30.1"W		
ICN				CALD	16	23/03/2011	Brasil	SC	Palhoça	Parque Estadual Serra do Tabuleiro, Baixada do Maciambu			
ICN				E.P. Fazolino	676	02/05/2016	Brasil	RS	São Francisco de Paula	Floresta Nacional de São Francisco de Paula			sobre árvore morta em pé
ICN				E.P. Fazolino	691	01/10/2016	Brasil	SC	Florianópolis	Parque Municipal Lagoa do Peri			
ICN				E.R. Drechsler-Santos	901	14/02/2013	Brasil	SC	Concórdia	Parque Estadual Fritz Plaumann			sobre galho morto em árvore viva
ICN				E.R. Drechsler-Santos	916	14/02/2013	Brasil	SC	Concórdia	Parque Estadual Fritz Plaumann			sobre galho morto suspenso
ICN				E.R. Drechsler-Santos	1142	21/10/2013	Brasil	SC	Urubici	Parque Nacional de São Joaquim, Santa Barbara			
ICN				E.R. Drechsler-Santos	1317	16/02/2014	Brasil	SC	Florianópolis	Parque Municipal Lagoa do Peri, Trilha do saquinho			sobre liana morta
ICN			**sim**	Alves-Silva, G.	1177	13/07/2017	Brasil	AM	Manaus	Praça da saudade			sobre galho morto de árvore
ICN				E.R. Drechsler-Santos	1318	16/02/2014	Brasil	SC	Florianópolis	Parque Municipal Lagoa do Peri, Trilha do saquinho			sobre galho morto
ICN				G. Alves-Silva	230	05/08/2012	Brasil	MT	Cuiabá	Parque Nacional Chapada dos Guimarães, Sítio Véu de Noiva	15°24'25.5"S 55°50'09.3"W		sobre galho morto
ICN				G. Alves-Silva	249	05/08/2012	Brasil	MT	Cuiabá	Parque Nacional Chapada dos Guimarães, Sítio Véu de Noiva	15°24'25.5"S 55°50'09.3"W		sobre galho morto
ICN				G. Alves-Silva	255	05/08/2012	Brasil	MT	Cuiabá	Parque Nacional Chapada dos Guimarães, Sítio Véu de Noiva	15°24'25.5"S 55°50'09.3"W		sobre galho morto
ICN				G. Alves-Silva	388	10/03/2013	Brasil	MT	Cuiabá	Parque Nacional Chapada dos Guimarães, Sítio Véu de Noiva	15°24'25.5"S 55°50'09.3"W		sobre galho morto
ICN				G. Alves-Silva	507	18/08/2013	Brasil	MT	Cuiabá	Parque Nacional Chapada dos Guimarães, Sítio Véu de Noiva	15°24'25.5"S 55°50'09.3"W		sobre galho morto
ICN				G. Alves-Silva	579	16/02/2014	Brasil	SC	Florianópolis	Parque Municipal Lagoa do Peri			sobre galho morto
ICN				G. Alves-Silva	583	21/03/2014	Brasil	SC	Florianópolis	UFSC, near to botany department			sobre galho morto em árvore viva
ICN				G. Alves-Silva	584	27/03/2014	Brasil	SC	Florianópolis	UFSC, near to botany department			sobre galho morto
ICN				G. Alves-Silva	587	05/04/2014	Brasil	SC	Florianópolis	UCAD			
ICN				G. Alves-Silva	611	05/08/2014	Brasil	SC	São Francisco de Assis	Parque Estadual Acaraí			sobre galho morto
ICN				G. Alves-Silva	612	05/08/2014	Brasil	SC	São Francisco de Assis	Parque Estadual Acaraí			sobre galho morto
ICN				G. Alves-Silva	617	06/08/2014	Brasil	SC	São Francisco de Assis	Parque Estadual Acaraí, módulo PPBio Acaraí (.75)	26°19'50.8"S 48°33'46.2"W		sobre galho morto
ICN				G. Alves-Silva	780	01/05/2016	Brasil	RS	Porto Alegre	UFRGS, Campus do Vale, fim das escadarias a esquerda			sobre árvore morta inclinada
ICN				G. Alves-Silva	833	19/07/2016	Brasil	RS	Porto Alegre	Morro Santana			sobre árvore morta em pé
ICN				G. Alves-Silva	834	19/07/2016	Brasil	RS	Porto Alegre	Morro Santana			sobre árvore morta em pé
ICN				G. Alves-Silva	835	19/07/2016	Brasil	RS	Porto Alegre	Morro Santana			sobre árvore morta em pé
ICN				G. Alves-Silva	842	27/07/2016	Brasil	RS	Porto Alegre	Morro Santana			sobre galho no solo
ICN				G. Alves-Silva	849	27/07/2016	Brasil	RS	Porto Alegre	Morro Santana			sobre galho morto suspenso contanto c/ solo
ICN				G. Alves-Silva	857	12/09/2016	Brasil	RS	Porto Alegre	UFRGS, Campus Agronomia			sobre galho morto
ICN				G. Alves-Silva	958	05/10/2016	Brasil	SC	Florianópolis	Trilha Naufragados	27°49'31.4"S 48°33'52.2"W		sobre árvore viva em pé
ICN				G. Alves-Silva	965	21/10/2016	Brasil	RS	Porto Alegre	Morro Santana			sobre galho no solo

Herbário	N° tombo	Tipo	Molecular	Coletor	Número de coletor	Dia coleta	País	Estado	Município	Localidade	Coordenadas	Alt.	Hábitat
Fomitiporia neotropica Camp.-Sant., Amalfi, R.M. Silveira, Robledo & Decock													
ICN			**sim**	G. Alves-Silva	994	27/12/2016	Brasil	MT	Cuiabá	Parque Nacional Chapada dos Guimarães, Sítio Véu de Noiva			na parte de baixo, árvore caída
ICN				G. Alves-Silva	1004	27/12/2016	Brasil	MT	Cuiabá	Parque Nacional Chapada dos Guimarães, Sítio Véu de Noiva			sobre galho no solo
ICN				G. Alves-Silva	1059	24/02/2017	Brasil	PR	Campo Mourão	Estação Ecológica do Cerrado	24°01'01.3"S 52°21'37.3"W		sobre árvore morta em pé
ICN				G. Alves-Silva	1065	24/02/2017	Brasil	PR	Campo Mourão	Fragmento de Cerrado			sobre galho morto suspenso
ICN				G. Alves-Silva	1101	27/02/2017	Brasil	PR	Foz do Iguaçu	Parque Nacional do Iguaçu			sobre galho no solo
ICN				G. Alves-Silva	1102	27/02/2017	Brasil	PR	Foz do Iguaçu	Parque Nacional do Iguaçu			sobre galho no solo
ICN				G. Alves-Silva	1113	21/04/2017	Brasil	RS	Viamão	Parque Estadual de Itapuã			sobre galho morto em árvore viva
ICN				G. Alves-Silva	1128	03/06/2017	Brasil	PR	Jaguariaíva	Parque Estadual do Cerrado			sobre galho morto suspenso contanto c/ solo
ICN				G. Alves-Silva	1129	03/06/2017	Brasil	PR	Jaguariaíva	Parque Estadual do Cerrado			sobre galho morto suspenso contanto c/ solo
ICN				G. Alves-Silva	1184	30/07/2017	Brasil	RS	Barra do Quaraí	Parque Estadual do Espinilho	30°11'37.3"S 57°29'19.3"W		sobre toco morto
ICN				G. Alves-Silva	1191	31/07/2017	Brasil	RS	Alegrete	Reserva Biológica Ibirapuitã, Capão, Floresta inundável	29°55'00.1"S 55°45'56.2"W		sobre árvore morta em pé
ICN				G. Alves-Silva	1203	01/08/2017	Brasil	RS	Santa Maria	Urban center	29°41'50.3"S 53°49'36.3"W		sobre galho morto em árvore viva
ICN				M.A. Reck	1285	11/02/2016	Brasil	SC	Florianópolis	Parque Municipal do Córrego Grande			
ICN				M.A. Reck	1286	11/02/2016	Brasil	SC	Florianópolis	Parque Municipal do Córrego Grande			
ICN				Marília	18	15/02/2014	Brasil	SC	Florianópolis	Lagoa do Peri			sobre galho no solo
ICN				V. Oliveira-Garcia	85	21/12/2016	Brasil	RS	El Dorado do Sul	Estação experimental da UFRGS	30°6'2"S 51°41'30"W	46m	
ICN				V. Oliveira-Garcia	91	09/01/2017	Brasil	RS	Porto Alegre	Morro Santana	30°3'42"S 51°7'35"W	311m	sobre árvore viva
ICN				V. Oliveira-Garcia	163	23/05/2017	Brasil	RS	Derrubadas	Parque Estadual do Turvo	27°14'41"S 53°57'51"W	360m	
ICN				V. Oliveira-Garcia	164	23/05/2017	Brasil	RS	Derrubadas	Parque Estadual do Turvo	27°14'41"S 53°57'51"W	360m	
ICN				V. Oliveira-Garcia	206	14/12/2017	Brasil	RS	Viamão	Parque Estadual de Itapuã	30°22'40"S 51°1'23"W		sobre árvore morta
ICN				V. Oliveira-Garcia	207	14/12/2017	Brasil	RS	Viamão	Parque Estadual de Itapuã	30°22'40"S 51°1'23"W		sobre árvore morta
ICN				G. Alves-Silva	1314	22/02/2018	Brasil	SC	Florianópolis	UCAD			sobre galho morto suspenso contanto c/ solo
INPA	110870			R.H. Petersen	382	03/11/1979	Brasil	RO	Vilhena	RO-399, 5-20 km on new road to Colorado, low montain forest			
INPA	229171			T.K. Kosonen	4740	10/05/2009	Brasil	AM	Manaus	Reserva Ducke			sobre árvore morta
SP	142125			V.L. Penteado		16/09/1977	Brasil	SP	Mogi-Guaçu	Fazenda Campininha			
SP	142134			V.L. Penteado		16/09/1977	Brasil	SP	Mogi-Guaçu	Fazenda Campininha			
SP	142170			V.L. Penteado		18/08/1977	Brasil	SP	Mogi-Guaçu	Fazenda Campininha			
SP	251080			A.M. Gugliotta		26/03/1996	Brasil	SP	São Paulo	Parque Estadual das Fontes do Ipiranga			
SP	307273			A.M. Gugliotta	700	16/01/1997	Brasil	SP	Itapecerica da Serra				sobre galho morto
SP	307447			M. Capelari	3531A	28/07/1990	Brasil	SP	Santo André	Reserva Biológica do Alto da Serra de Paranapiacaba			
SP	416257			S.P. Macedo	14	17/09/2009	Brasil	SP	São Paulo	Parque Alfredo Volpi	23°35'S 46°42'W		
SP	417861			V. Motato-Vásquez	57	06/06/2011	Brasil	SP	São Paulo	Parque Estadual da Cantareira, Núcleo Engordador			
SP	417862			V. Motato-Vásquez	76	06/06/2011	Brasil	SP	São Paulo	Parque Estadual da Cantareira, Núcleo Engordador			sobre galho morto
Fomitiporia nubicola **sp. nov.** Alves-Silva, Reck & Drechsler-Santos													
FLOR	58533			Alves-Silva, G.	660	20/06/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Santa Barbara.			
FLOR	57850	**T**	**sim**	Alves-Silva, G.	630	31/10/2014	Brasil	SC	Urubici	Parque Nacional de São Joaquim, Morro da Igreja.	28°07'14.0"S 49°29'31.0"W	1700m	sobre árvore viva (*Drimys angustifolia*)
FLOR	57851		**sim**	Alves-Silva, G.	608	21/06/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Santa Barbara.	28°09'18.0"S 49°38'24.0"W	1500m	sobre árvore viva (*Drimys angustifolia*)
FLOR	57852		**sim**	Alves-Silva, G.	659	04/12/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Santa Barbara.	28°09'18.0"S 49°38'24.0"W	1571m	sobre árvore viva (*Drimys angustifolia*)
FLOR	57853		**sim**	E.R. Drechsler-Santos	1336	04/03/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Santa Barbara.	28°09'18.0"S 49°38'24.0"W	1500m	sobre árvore viva (*Drimys angustifolia*)
FLOR	57854		**sim**	Alves-Silva, G.	632	31/10/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Morro da Igreja.	28°07'14.0"S 49°29'31.0"W	1700m	sobre árvore morta em pé (*Drimys angustifolia*)
FLOR	57855		**sim**	Alves-Silva, G.	647	26/11/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Morro da Igreja.	28°07'14.0"S 49°29'31.0"W	1715m	sobre árvore morta em pé (*Drimys angustifolia*)
FLOR	57856		**sim**	Alves-Silva, G.	649	26/11/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Morro da Igreja.	28°07'14.0"S 49°29'31.0"W	1724m	sobre árvore morta em pé (*Drimys angustifolia*)
FLOR	57857		**sim**	Alves-Silva, G.	650	26/11/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Morro da Igreja.	28°07'14.0"S 49°29'31.0"W	1716m	sobre árvore morta em pé (*Drimys angustifolia*)
FLOR	57858		**sim**	Alves-Silva, G.	651	26/11/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Morro da Igreja.	28°07'14.0"S 49°29'31.0"W	1720m	sobre árvore morta em pé (*Drimys angustifolia*)
FLOR	57859		**sim**	Alves-Silva, G.	655	26/11/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Morro da Igreja.	28°07'14.0"S 49°29'31.0"W	1712m	sobre árvore morta em pé (*Drimys angustifolia*)
FLOR	58529			Reck, M.A.	933	03/12/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Santa Barbara.	28°09'18.0"S 49°38'24.0"W	1500m	sobre árvore morta em pé
FLOR	58530			Salvador-Montoya, C.	544	20/10/2013	Brasil	SC	Urubici	Parque Nacional São Joaquim, Morro da Igreja.	28°07'14.0"S 49°29'31.0"W		sobre árvore morta em pé
FLOR	58532			Salvador-Montoya, C.	549	22/10/2013	Brasil	SC	Urubici	Parque Nacional São Joaquim, Santa Barbara.	28°09'18.0"S 49°38'24.0"W	1500m	sobre árvore morta em pé
FLOR	58535			Alves-Silva, G.	591	20/06/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Santa Barbara.	28°09'18.0"S 49°38'24.0"W		sobre árvore morta em pé
FLOR	58536			Alves-Silva, G.	597	20/06/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Santa Barbara.	28°09'18.0"S 49°38'24.0"W		sobre árvore morta em pé
FLOR	58537			Salvador-Montoya, C.	547	20/10/2013	Brasil	SC	Urubici	Parque Nacional São Joaquim, Morro da Igreja.	28°07'14.0"S 49°29'31.0"W		sobre árvore morta em pé
FLOR	58539			Salvador-Montoya, C.	546	20/10/2013	Brasil	SC	Urubici	Mata nebular, Trilha da Pedra furada.	28°07'14.0"S 49°29'31.0"W		sobre árvore morta em pé
FLOR	58540			Alves-Silva, G.	656	26/11/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Morro da Igreja.	28°07'14.0"S 49°29'31.0"W	1711m	sobre árvore morta em pé (*Drimys angustifolia*)
FLOR	58541			Alves-Silva, G.	631	31/10/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Morro da Igreja.	28°07'14.0"S 49°29'31.0"W		sobre árvore morta em pé (*Drimys angustifolia*)
FLOR	58542			Alves-Silva, G.	654	26/11/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Morro da Igreja.	28°07'14.0"S 49°29'31.0"W	1711m	sobre árvore morta em pé (*Drimys angustifolia*)
FLOR	58543			Alves-Silva, G.	629	31/10/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Morro da Igreja.	28°07'14.0"S 49°29'31.0"W		sobre árvore morta em pé (*Drimys angustifolia*)
FLOR	58544			Alves-Silva, G.	652	26/11/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Morro da Igreja.	28°07'14.0"S 49°29'31.0"W	1713m	sobre árvore morta em pé (*Drimys angustifolia*)
FLOR	58545		**sim**	Alves-Silva, G.	648	26/11/2014	Brasil	SC	Urubici	Parque Nacional São Joaquim, Morro da Igreja.	28°07'14.0"S 49°29'31.0"W	1717m	sobre árvore morta em pé (*Drimys angustifolia*)

Herbário	N° tombo	Tipo	Molecular	Coletor	Número de coletor	Dia coleta	País	Estado	Município	Localidade	Coordenadas	Alt.	Hábitat
Fomitiporia nubicola **sp. nov.** Alves-Silva, Reck & Drechsler-Santos													
FLOR	58592			Salvador-Montoya, C.	548	20/10/2013	Brasil	SC	Urubici	Parque Nacional de São Joaquim, Morro da Igreja.	28°07'14.0"S 49°29'31.0"W		sobre árvore morta em pé
FLOR	58599			E.R. Drechsler-Santos	634	24/11/2011	Brasil	SC	Urubici	Parque Nacional São Joaquim, Santa Barbara.	28°09'18.0"S 49°38'24.0"W		sobre árvore morta em pé
FURB	52808		**sim**	F. Bittencourt	845	23/09/2016	Brasil	SC	Rodeio	Eremitério Beato Frei Egídio	26°52'41"S 49°24'02"W	850m	sobre árvore morta em pé (*Drimys* sp.)
Fomitiporia prolongata ad int. **sp. nov.** Alves-Silva, R.M. Silveira & Drechsler-Santos													
ICN			**sim**	Alves-Silva, G.	880	18/09/2016	Brasil	BA	Camacã	RPPN Serra Bonita, Tower trail			Na base de árvore viva
ICN				Alves-Silva, G.	884	18/09/2016	Brasil	BA	Camacã	RPPN Serra Bonita, Tower trail			Na base de árvore viva
ICN			**sim**	Alves-Silva, G.	903	19/09/2016	Brasil	BA	Uruçuca	Parque Estadual Serra do Condurú	14°29'40,9"S 39°08'01,8"W		sobre morta inclinada
ICN			**sim**	Alves-Silva, G.	915	20/09/2016	Brasil	BA	Uruçuca	Parque Estadual Serra do Condurú	14°29'40,9"S 39°08'01,8"W	630m	sobre árvore morta em pé
ICN			**sim**	Alves-Silva, G.	1139	07/06/2017	Brasil	PR	Matinhos	Parque Nacional Saint-Hilaire/Lange	25°40'23.7"S 48°35'48.7"W	190m	sobre toco morto
ICN			**sim**	Alves-Silva, G.	896	19/09/2016	Brasil	BA	Uruçuca	Parque Estadual Serra do Condurú	14°29'40,9"S 39°08'01,8"W		sobre toco morto
INPA	84110			M.A. Souza & M.G. Silva	371	14/03/1978	Brasil	PA	Belem	Mata do Utinga, mata de terra firme			sobre toco seco de Louro (*Aniba* sp., Lauraceae)
ICN				Alves-Silva, G.	859	17/09/2016	Brasil	BA	Camacã	RPPN Serra Bonita, Trilha 1	15°23'23.6"S 39°33'57.6"W	900m	sobre toco morto
Fomitiporia puiggarii ad int. **sp. nov.** Alves-Silva, R.M. Silveira & Drechsler-Santos													
FLOR	58555	**T**	**sim**	Alves-Silva, G.	674	13/12/2014	Brasil	SP	Apiaí	PNM Morro do Ouro	24°31'13.25"S 48°50'11.13"W	850m	sobre árvore morta em pé
ICN			**sim**	Reck, M.A.	1247	23/01/2016	Brasil	PR	Piraquara	Morro do Canal			
Fomitiporia pulvinata ad int. **sp. nov.** Alves-Silva, R.M. Silveira & Drechsler-Santos													
ICN		**T**	**sim**	Alves-Silva, G.	1073	25/02/2017	Brasil	PR	Campo Mourão	Parque Estadual do Lago Azul			sobre tronco caído em contato com solo
Fomitiporia punctata (P. Karst.) Murrill													
SP	127996			M.A. Bondartseva		02/09/1967	Russia		Irkutsk				sobre árvore morta
Fomitiporia rondoni ad int. **sp. nov.** Alves-Silva & Drechsler-Santos													
FLOR	58557	**T**	**sim**	Alves-Silva, G.	726	08/02/2015	Brasil	MT	Cuiabá	PN Chapada dos Guimarães, Sítio Véu de Noiva	15°24'23.19"S 55°50'12.14"W		sobre árvore morta
ICN		**PT**	**sim**	Engels, M.	26F		Brasil	MT	Itaúba				sobre árvore morta em pé
Fomitiporia rhizophila ad int. **sp. nov.** Alves-Silva, R.M. Silveira & Drechsler-Santos													
ICN		**T**	**sim**	Alves-Silva, G.	1071	25/02/2017	Brasil	PR	Campo Mourão	Parque Estadual do Lago Azul	24º06'15.2"S 52º18'30.1"W		na base e raíz de árvore viva
ICN		**PT**	**sim**	Alves-Silva, G.	1072	25/02/2017	Brasil	PR	Campo Mourão	Parque Estadual do Lago Azul	24º06'15.2"S 52º18'30.1"W		Na base de árvore morta em pé
Fomitiporia sanctichampagnatii G. Coelho, R.M. Silveira & Rajchenb.													
ICN	139044	**T**		G. Coelho		10/06/2005	Brasil	RS	São Francisco de Paula	Pró-Mata, Trilha três forquilhas			sobre colmo de bambu morto
ICN	139201	**PT**		G. Coelho	492-1	01/06/2006	Brasil	RS	São Francisco de Paula	Pró-Mata, Trilha três forquilhas			sobre colmo de bambu morto
ICN	139202	**PT**		G. Coelho	492-2	01/06/2006	Brasil	RS	São Francisco de Paula	Pró-Mata, Trilha três forquilhas			sobre colmo de bambu morto
ICN	139203	**PT**		G. Coelho	492-3	01/06/2006	Brasil	RS	São Francisco de Paula	Pró-Mata, Trilha três forquilhas			sobre colmo de bambu morto
Fomitiporia sp. PS1													
ICN			**sim**	Alves-Silva, G.	886	18/09/2016	Brasil	BA	Camacã	RPPN Serra Bonita, Tower trail	15°23'14.0"S 39°33'50.9"W	900m	sobre árvore morta em pé
ICN			**sim**	Alves-Silva, G.	895	18/09/2016	Brasil	BA	Camacã	RPPN Serra Bonita, Tower trail	15°23'14.0"S 39°33'50.9"W	900m	
Fomitiporia sp.													
ICN			**sim**	Alves-Silva, G.	981	26/11/2016	Brasil	RS	São Francisco de Paula	Floresta Nacional de São Francisco de Paula			on standing dead unidentified angiosperm
Fomitiporia sp.													
ICN			**sim**	V. Oliveira-Garcia	84	21/12/2016	Brasil	RS	El Dorado do Sul	Estação experimental da UFRGS	30°6'2"S 51°41'30"W		on living Myrcianthes gigantea
Fomitiporia sp.													
FLOR	58550		**sim**	Alves-Silva, G.	748	15/09/2015	Brasil	SC	Florianópolis	Morro da Lagoa, CASAN	27°35'09.2"S 48°28'36.7"W		sobre árvore viva em pé (Matayba guianensis)
Fomitiporia spinescens (J.E. Wright & G. Coelho) G. Coelho, Guerrero & Rajchenb.													
FLOR	11433			G. Coelho		09/09/1992	Brasil	RS	Santa Maria	Itaara, P. Pinhal			sobre colmo de bambu morto
ICN	97790	**T**		G. Coelho	29-9	09/09/1992	Brasil	RS	Santa Maria	Itaara, P. Pinhal			sobre colmo de bambu morto
ICN	97791	**PT**		G. Coelho	31-5	05/10/1992	Brasil	RS	Santa Maria	Itaara, P. Pinhal			sobre colmo de bambu morto
ICN	97792	**PT**		G. Coelho	31-6	05/10/1992	Brasil	RS	Santa Maria	Itaara, P. Pinhal			sobre colmo de bambu morto
ICN	97793	**PT**		G. Coelho	31-6	05/10/1992	Brasil	RS	Santa Maria	Itaara, P. Pinhal			sobre colmo de bambu morto
ICN	97794	**PT**		G. Coelho	38-8	06/04/1993	Brasil	RS	Santa Maria	Itaara, P. Pinhal			sobre colmo de bambu morto
ICN	97795	**PT**		G. Coelho	38-11	09/04/1993	Brasil	RS	Santa Maria	Itaara, P. Pinhal			sobre colmo de bambu morto
ICN	97796	**PT**		G. Coelho	42-6	03/06/1993	Brasil	RS	Santa Maria	Itaara, P. Pinhal			sobre colmo de bambu morto
ICN	97797	**PT**		G. Coelho	48-3	03/10/1993	Brasil	RS	Santa Maria	Itaara, P. Pinhal			sobre colmo de bambu morto
ICN	97798	**PT**		G. Coelho	48-7	03/10/1993	Brasil	RS	Santa Maria	Itaara, P. Pinhal			sobre colmo de bambu morto
ICN	102208			G. Coelho	53-1	05/10/1992	Brasil	RS	Santa Maria	Itaara, P. Pinhal			sobre colmo de bambu morto
ICN	102285			G. Coelho	43258	23/12/1991	Brasil	RS	Santa Maria	Itaara, P. Pinhal			sobre colmo de bambu morto
ICN	200565			Reck, M.A.	745	04/09/2013	Brasil	PR	Piraquara	Morro do Canal			sobre colmo de bambu morto
ICN	200566		**sim**	Reck, M.A.	1193	19/01/2016	Brasil	SP	Caraguatatuba	Parque Estadual Serra do Mar			sobre colmo de bambu morto

Herbário	N° tombo	Tipo	Molecular	Coletor	Número de coletor	Dia coleta	País	Estado	Município	Localidade	Coordenadas	Alt.	Hábitat
Fomitiporia subtilissima Alves-Silva, Reck & Drechsler-Santos													
FURB	47437	**PT**	**sim**	F. Bittencourt	428	13/05/2015	Brasil	SC	Blumenau	Parque Natural Municipal São Francisco de Assis	26°55'17"S 49°04'19"W		
FURB	47557	**T**	**sim**	F. Bittencourt	493	28/07/2015	Brasil	SC	Blumenau	Parque Natural Municipal São Francisco de Assis	26°55'17"S 49°04'19"W		
FURB	48913			F. Bittencourt	588	30/09/2015	Brasil	SC	Blumenau	Parque Natural Municipal São Francisco de Assis	26°55'17"S 49°04'19"W		
FURB	51325			F. Bittencourt	742	29/01/2016	Brasil	SC	Blumenau	Parque Natural Municipal São Francisco de Assis	26°55'17"S 49°04'19"W		
FURB	52326			F. Bittencourt	743	29/01/2016	Brasil	SC	Blumenau	Parque Natural Municipal São Francisco de Assis	26°55'17"S 49°04'19"W		
ICN	200567		**sim**	Alves-Silva, G.	904	19/09/2016	Brasil	BA	Uruçuca	PE Serra do Condurú, Trilha Fomitopsis	14º29'40.9"S 39º08'01.8"W	600m	na base de árvore morta inclinada
ICN	200568		**sim**	Alves-Silva, G.	1276	06/02/2018	Brasil	SP	Apiaí	Parque Natural Municipal Morro do Ouro	24º31'16.2"S 48º50'14.5"W	919m	sobre as raízes expostas de canela caída
ICN				Jesus, M.A.	6371	13/11/2009	Brasil	RR		PN do Viruá, L3 1500 30-40			sobre árvore viva
Fomitiporia tsugina Murrill													
SP	141504			W.B. & V.G. Cooke	39843	01/09/1968	USA	OHIO	Hocking County	Crane Hollow, MAS Forest			sobre *Tsuga canadensis*
Fomitiporia uncinata (Rajchenb.) G. Coelho, Guerrero & Rajchenb.													
BAFC	29836	**T**		D. Job	Ml- 3608	06/04/1984	Argentina	Misiones		Iguazu Nat' l Park , Macuco path			sobre colmo de bambu morto
ICN	200561		**sim**	Alves-Silva, G.	808	18/05/2016	Brasil	RS	São Francisco de Paula	Pró-Mata	29°28'35.7"S 50°09'58.3"W	900m	sobre colmo de bambu morto

Apêndice C — Filogenia de nrITS

Apêndice C. Árvore filogenética das espécies de *Fomitiporia*, baseada em Máxima Verossimilhança de nrITS. Em negrito estão os espécimes obtidos nesse trabalho.

Marcador: nrITS

Matriz: 935 pb

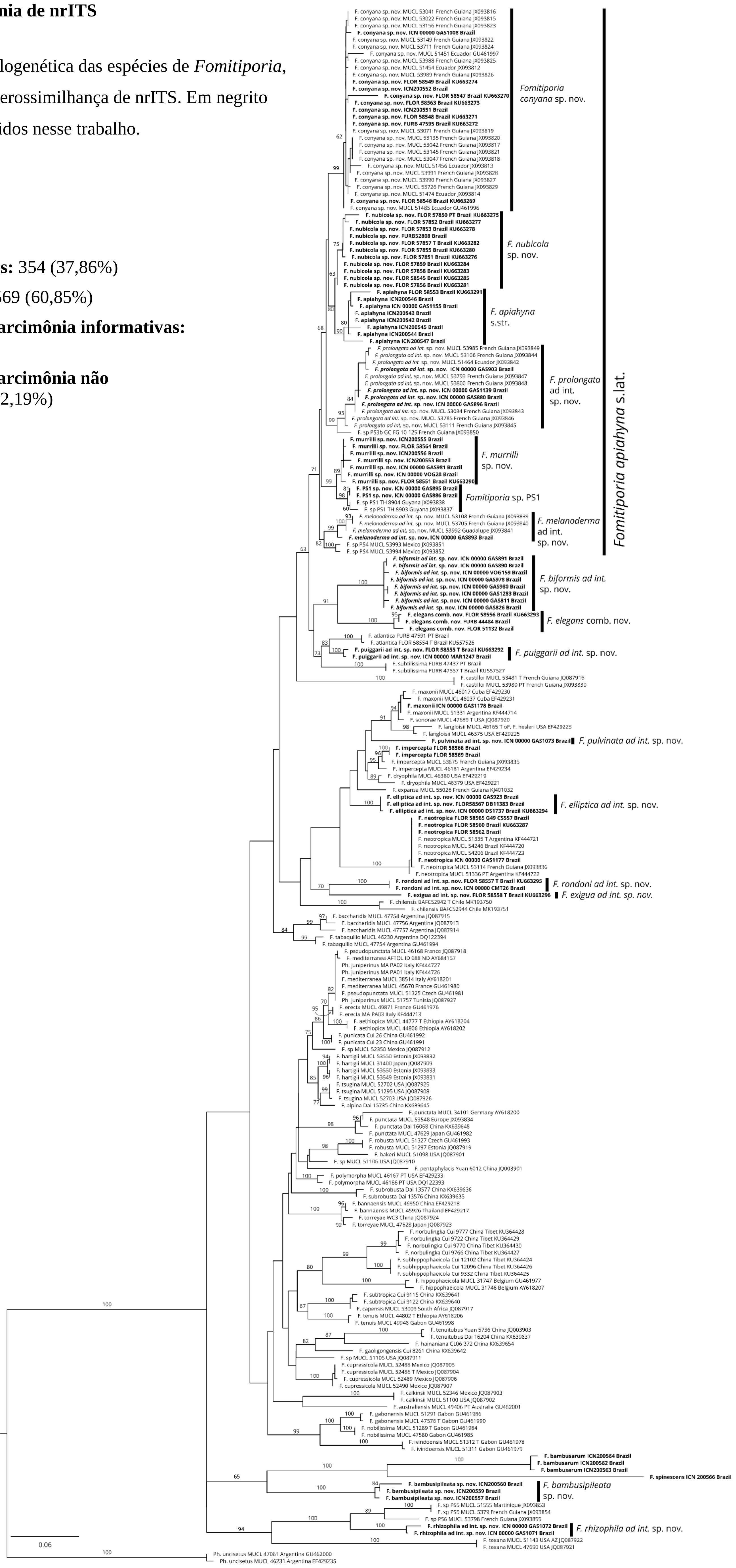
Terminais: 222

Posições conservadas: 354 (37,86%)

Posições variáveis: 569 (60,85%)

Posições variáveis parcimônia informativas: 455 (48,66%)

Posições variáveis parcimônia não informativas: 114 (12,19%)



Apêndice D — Filogenia de nrLSU

Apêndice D. Árvore filogenética das espécies de *Fomitiporia*, baseada em Máxima Verossimilhança de nrLSU. Em negrito estão os espécimes obtidos nesse trabalho.

Marcador: nrLSU

Matriz: 900 pb

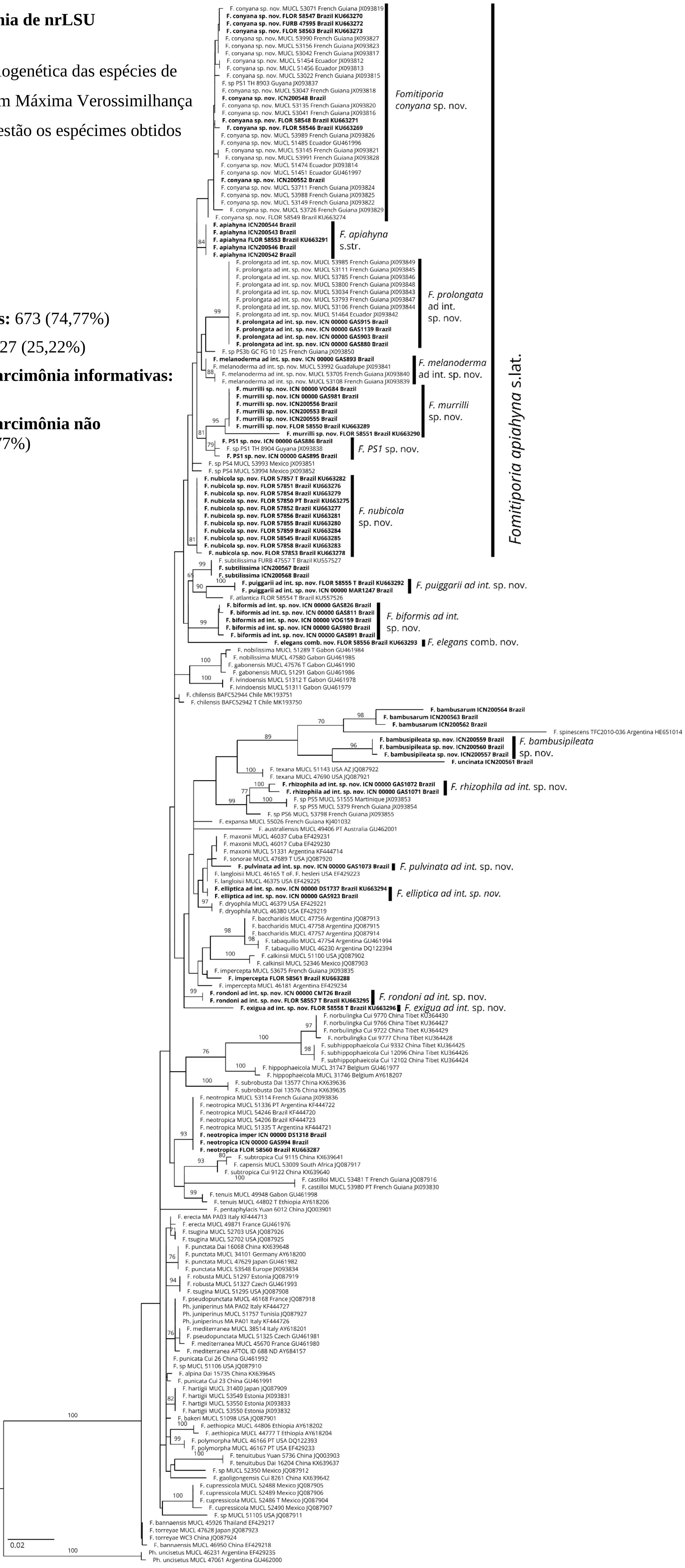
Terminais: 209

Posições conservadas: 673 (74,77%)

Posições variáveis: 227 (25,22%)

Posições variáveis parcimônia informativas: 157 (17,44%)

Posições variáveis parcimônia não informativas: 70 (7,77%)



Apêndice E — Filogenia de RPB2

Apêndice E. Árvore filogenética das espécies de Fomitiporia, baseada em Máxima Verossimilhança de *RPB2*. Em negrito estão os espécimes obtidos nesse trabalho.

Marcador: RPB2

Matriz: 813 pb

Terminais: 201

Posições conservadas: 490 (60,27%)

Posições variáveis: 323 (39,72%)

Posições variáveis parcimônia informativas: 293 (36,03%)

Posições variáveis parcimônia não informativas: 30 (3,69%)

Apêndice F — Filogenia de TEF1

Apêndice F. Árvore filogenética das espécies de Fomitiporia, baseada em Máxima Verossimilhança de *TEF1*. Em negrito estão os espécimes obtidos nesse trabalho.

Marcador: *TEF1*

Matriz: 1.196 pb

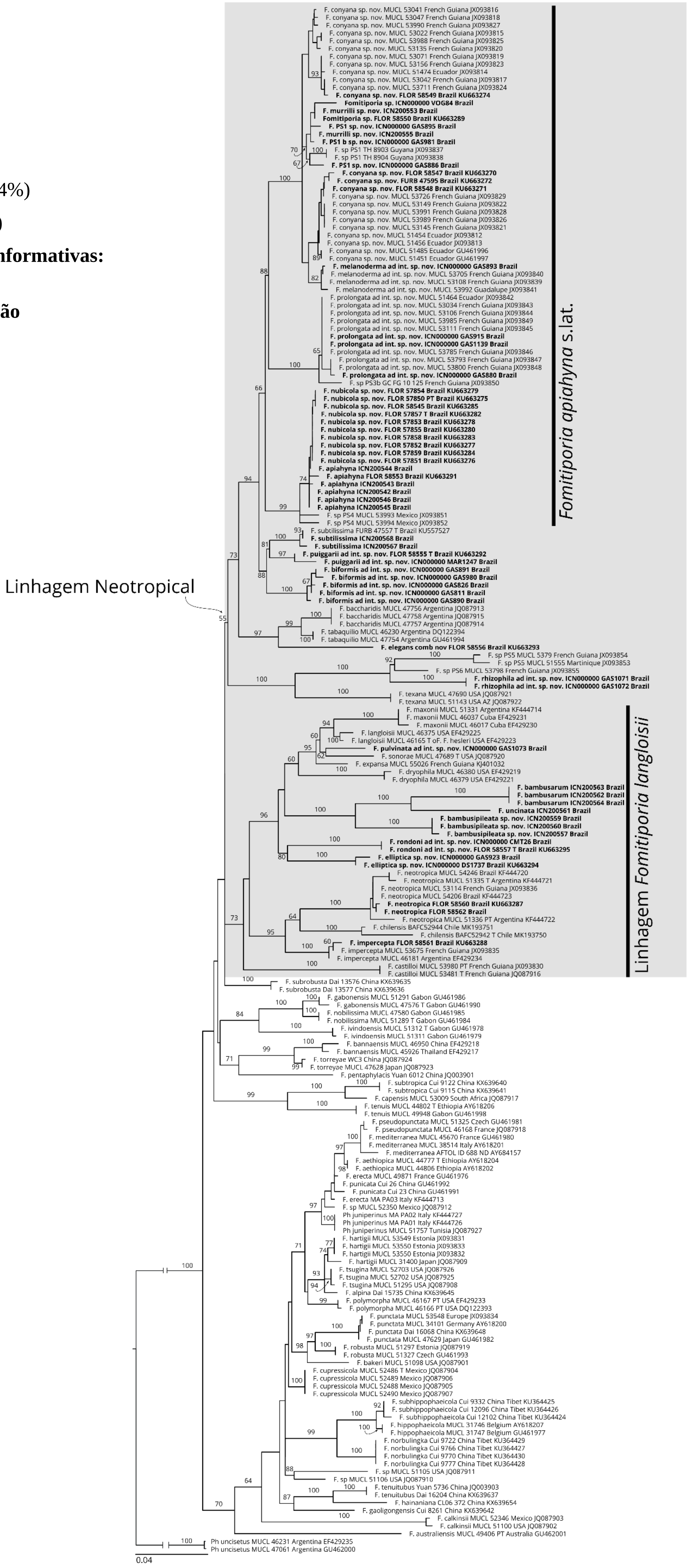
Terminais: 199

Posições conservadas: 705 (58,94%)

Posições variáveis: 489 (40,88%)

Posições variáveis parcimônia informativas: 428 (35,78%)

Posições variáveis parcimônia não informativas: 61 (5,1%)



Apêndice G — Protocolo extração de DNA fúngico (tecido pigmentado, para pequenas porções)

1. Separe um pequeno pedaço do espécime (porções jovens; 1–2 mm^3) em um microtubo de 1,5 µL com 200 µL de CTAB.

2. Encube a 65 °C por 30–60 min ou *overnight*. Macere utilizando o pistilo para microtubo.

3. Adicione 200 µL de tampão CTAB pré-aquecido em banho maria e leve ao vortex para homogeneizar bem.

4. Deixe em banho maria a 65 °C por cerca de 40 min. Nos primeiros 10 min, a cada 2 min, homogeneizar as amostras manualmente com cuidado.

5. Retire os tubos e leve ao freezer por 15 min, ou até congelar; devolva no banho maria e deixe por 10 min, repita o congelamento e termine deixando no banho maria por 30 min.

6. Centrifugue por 15 min a 12.200 rpm, em seguida aspire a parte líquida e pipete em um novo tubo de 2,0 mL; o volume dessa parte líquida poderá ser em torno de 400 µL ou menor, se preferir não sugar sujeira.

> **Nota:** Mesmo se pipetar sujeira, essa sairá quando utilizar-vos o Clorofórmio:Álcool isoamílico.

7. Acrescente 400 µL Clorofórmio:Álcool isoamílico gelado e agite manualmente por 5 min.

8. Centrifugue por 5 min, resfrie em freezer por 1–2 min e centrifugue por mais 5 min (ou 10 min em centrífuga refrigerada à 4 °C).

9. Pipete o sobrenadante em um novo tubo de 2,0 mL, esse sobrenadante terá cerca de 250 µL; padronize para tirar igual volume de todas as amostras.

10. Adicione igual volume (250 µL) de Clorofórmio:Álcool isoamílico gelado e agite manualmente por 5 min;

> **Nota:** Nesse momento não pode aspirar sujeira. Caso isso ocorra, faça uma nova lavagem com Clorofórmio:Álcool isoamílico, da mesma forma que já foi feita anteriormente. Essa solução aquosa aspirada pode estar pigmentada, porém deve estar TRANSLÚCIDA.

11. Centrifugue por 5 min, resfrie em freezer por 1–2 min e centrifugue por mais 5 min (ou 10 min em centrífuga refrigerada a 4 °C).

12. Pipete o sobrenadante em um novo tubo de 1,5 mL, esse sobrenadante terá cerca de 150 µL; padronize para tirar igual volume de todas as amostras e adicione igual volume de Isopropanol gelado. Deixe *overnight* no freezer.

No outro dia:

13. Centrifugue a 12.200 rpm por 15 min, porém a cada 5 min, resfrie 1–2 min, inclusive depois dos últimos 5 min (ou 15 min na centrífuga refrigerada a 4 °C); descarte o sobrenadante e adicione 200 μL de Etanol 70%.

14. Centrifugue por 3 min, resfrie por 2 min e descarte o sobrenadante (5 min em centrífuga refrigerada);

> **Nota:** Sempre observe a presença de *pellet* e sua permanência no fundo do tubo. Porém ausência de *pellet* não é resultado negativo.

15. Repita os passos 13 e 14.

16. Deixe os tubos virados para baixo sobre papel toalha e depois os coloque na estante de tubos com um papel limpo sobre eles, para total evaporação do etanol à 65–72 °C (banho seco ou estufa).

17. Após a secagem total, adicione 30 μL de tampão TE ou água destilada autoclavada.

18. Deixe o DNA ressuspendendo por 2 h à 65 °C, ou deixe por no mínimo um dia na geladeira a 4 °C. Guarde no freezer (-20 °C) para posterior uso na PCR ou já realize a eletroforese de DNA total.