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TAXONOMIA E SISTEMÁTICA DE BOLETACEAE (BOLETALES) PARA O BRASIL

Dissertação submetida ao Programa de Pós-Graduação em Biologia de Fungos, Algas e Plantas da Universidade Federal de Santa Catarina para a obtenção do Grau de Mestre em Biologia Vegetal.
Orientador: Prof. Dra. Maria Alice Neves

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Esta Dissertação foi julgada adequada para obtenção do Título de Mestre, e aprovada em sua forma final pelo Programa de Pós-Graduação em Biologia de Fungos, Algas e Plantas.

Florianópolis, 10 de março de 2014.

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Austroboletus festivus
(Singer) Wolfe

Dedico este trabalho à minha família,
aos meus amigos, ao meu companheiro,
e em especial à turma MICOLAB!

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RESUMO

O conhecimento sobre os fungos boletoides nas regiões tropicais e subtropicais do hemisfério sul ainda é bastante limitado, havendo escassez de dados acerca da diversidade e distribuição dos mesmos. Com o objetivo de contribuir para o conhecimento de Boletaceae foram estudados materiais coletados em diferentes regiões do Brasil. Quatorze táxons foram identificados em cinco gêneros (*Austroboletus*, *Boletellus*, *Chalciporus*, *Fistulinella* e *Tylopilus*), sendo que sete são espécies novas: *F. alboaurantiaca* (RN), *F. conduruensis* (BA), *F. rhytidocystidiata* (ES), *T. dimorphicus* (AM), *T. nigrostipitatus* (PB), *T. pygmaeus* (BA) e *T. versiformis* (PB). *Tylopilus balloui* foi registrado pela primeira vez para o Brasil. *Fistulinella cinereoalba* foi registrada pela primeira vez para o Brasil. *Chalciporus trinitensis* var. *amazonicus* foi registrado pela primeira vez para o Espírito Santo e *A. festivus* é o primeiro registro para Santa Catarina. *Boletellus ananas* e *B.* cf. *lepidospora* foram recoletados nas florestas brasileiras. Para todos os táxons são apresentadas fotografias dos basidiomas, descrições macro e micromorfológicas com ilustrações e microscopia eletrônica de varredura (MEV) dos basidiosporos. Os resultados mostraram uma diversidade pouco conhecida de Boletaceae nas florestas brasileiras e uma indicação de que ainda há mais novidades para a ciência no que diz respeito a essa família. O incremento no conhecimento dos táxons de Boletaceae e a importância ecológica da família devido à associação com plantas hospedeiras dá subsídios importantes para planos de conservação em áreas onde esses táxons ocorrem.

Palavras-chave: Agaricomycetes, Basidiomycota, neotrópicos, sistemática, taxonomia.

ABSTRACT

Knowledge about boletoid fungi in tropical and subtropical regions of the southern hemisphere is still quite limited and few data regarding their diversity and distribution are available. In order to contribute to the knowledge of the diversity of Boletaceae, specimens from different regions of Brazil were studied. A total of 14 taxa belonging to five genera (*Austroboletus*, *Boletellus*, *Chalciporus*, *Fistulinella* and *Tylopilus*) have been identified, from which seven are new species: *F. alboaurantiaca* (RN), *F. conduruensis* (BA), *F. rhytidocystidiata* (ES), *T. dimorphicus* (AM), *T. nigrostipitatus* (PB), *T. pygmaeus* (BA), and *T. versiformis* (PB). *Tylopilus balloui* was registered for the first time for Brasil. *Fistulinella cinereoalba* was registered for the first time for Brazil. *Chalciporus trinitensis* var. *amazonicus* was registered for the first time for Espírito Santo, and *A. festivus* is a new record for Santa Catarina. *Boletellus ananas* and *B.* cf. *lepidospora* were recollected in the Brazilian forests. Photographs of the basidiomes, fully macro and microscopic descriptions with illustrations, and Scanning Electron Microscopy (SEM) of the basidiospores are presented for each species. The results showed that the diversity of Boletaceae in Brazilian forests is still not very well known and indicates that there are more new species for science to be described. The increase in the knowledge about the Boletaceae and the ecological importance of the family due to the association with plants provides data to build conservation plans in areas where these taxa grow.

Key-words: Agaricomycetes, Basidiomycota, Neotropics, systematic, taxonomy.

SUMÁRIO

1. INTRODUÇÃO

1.1 Caracterização de Boletaceae Chevall.

Os fungos pertencentes a Boletaceae (Chevallier 1826, Boletales *sensu* Jülich 1981, Agaricales, Subordem Boletineae *sensu* Singer 1986, Alexopoulos et al. 1996 e Binder & Hibbett 2006) apresentam basidiomas epígeos, conspícuos, com desenvolvimento geralmente gimnocárpico ou pseudoangiocárpico, terrestres, de hábito solitário ou gregário. Geralmente são robustos, com estipe central a levemente excêntrico. A coloração do píleo e do estipe podem variar desde tons pálidos como branco, creme, marron e rosado até cores mais vibrantes como vermelho e alaranjado. A superfície do píleo pode ser glabra, tomentosa ou escamosa, víscida ou seca. Apresentam himenóforo tubular, às vezes lamelar (*Phylloporus* Quél., *Phylloboletellus* Singer), com inserção decurrente, adnata, adnexa ou depressa. Algumas espécies apresentam reação azulada no contexto ou na superfície do basidioma quando expostos, em resposta à oxidação de derivados do ácido pulvínico, como o variegático, xerocômico e o atrotomentínico (Nelsen 2010). A esporada pode ser olivácea, amarelada, amarronzada, avermelhada ou rósea. Os esporos são subglobosos, oblongos, elípticos, alongados ou fusiformes, geralmente pigmentados e lisos, mas podendo apresentar ornamentações em alguns gêneros (p.ex. *Afroboletus* Pegler & T.W.K. Young, *Austroboletus* (Corner) Wolfe, *Boletellus* Murrill, *Heimioporus* E. Horak, *Strobilomyces* Berk.). Os basídios são do tipo holobasídio, geralmente clavados, apresentando no máximo quatro esterigmas. Trama do tubo bilateral ou divergente e fíbulas presentes ou ausentes.

1.2 Sistemática e classificação

Fries (1821) em *Systema Mycologicum* foi o primeiro a propor um sistema de classificação de fungos. Nesse trabalho ele sugere a criação de dois gêneros de fungos pileado-estipitados com himenóforo tubular: *Boletus* L. e *Fistulina* Bull., onde no primeiro os tubos estariam conectados entre si pelo dissepimento e no segundo os tubos estariam livres entre si.

Em 1826 Chevallier propõe Boletaceae (Agaricales) a fim de separar basidiomas com himenóforo tubular de Agaricaceae, que apresentava himenóforo lamelar, subdividindo Boletaceae em cinco gêneros: *Boletus* L., *Cladoporus* (Pers.) Chevall., *Fistulina* Bull., *Physisporus* Chevall. e *Polyporus* P. Micheli.

Smith & Thiers (1971) reconhecem Boletaceae Chevallier (Agaricales) circunscrevendo táxons de basidiomas carnosos, himenóforo tubular e trama do tubo bilateral, e incluem dez gêneros (*Boletus* L., *Boletellus* Murrill, *Fuscoboletinus* Pomerl. & A.H. Sm., *Gastroboletus* Lohwag, *Gyroporus* Quél., *Leccinum* Gray, *Pulveroboletus* Murrill, *Suillus* Gray, *Strobilomyces* Berk. e *Tylopilus* P. Karst.). *Phylloporus* Quél., gênero com himenóforo lamelar e trama bilateral, foi incluído em Paxillaceae, junto com *Gyrodon Opat.*.

Singer (1986), mantendo a classificação com base nas características morfológicas, subdivide Boletineae (Agaricales) em três famílias: Boletaceae (com himenóforo tubular), Gomphidiaceae (com himenóforo lamelar e esporada branca, creme ou marrom) e Paxillaceae (com himenóforo lamelar e esporada acinzentada, preta ou verde oliva). Boletaceae passa a ser subdividida em seis subfamílias: Boletoideae (*Austroboletus* (Corner) Wolfe, *Boletus* L., *Boletellus* Murrill, *Boletochaete* Singer, *Chalciporus* Bataille, *Fistulinella* Henn., *Leccinium* Gray, *Phylloboletellus* Singer, *Porphyrellus* E.-J. Gilbert, *Pulveroboletus* Murril, *Tylopilus* P. Karst., *Veloporphyrellus* L.D. Gómez & Singer e *Xanthoconium* Singer), Gyrodontoideae (*Gyrodon* Opat., *Meiorganum Heim*, *Paragyrodon* Singer (Singer) e *Phlebopus* (R. Heim) Singer), Gyroporoideae (*Gyroporus* Quél.), Suilloideae (*Boletinus* Kalchbr., *Psiloboletinus* Singer e *Suillus* Gray), Strobilomycetoideae (*Strobilomyces* Berk.) e Xerocomoideae (*Phylloporus* Quél., *Tubosaeta* Horak e *Xerocomus Quél.*).

Em *Agaricales in Modern Taxonomy* (Singer 1986), é reconhecido 25 gêneros e 415 espécies em Boletaceae. De acordo com o *Dictionary of the Fungi* (Kirk et al. 2008) são reconhecidos 35 gêneros em Boletaceae, acomodando 787 espécies. Com a publicação de novos trabalhos, mais nove gêneros propostos foram adicionados: *Bothia* (Halling et al. 2007); *Durianella* (Desjardin et al. 2008), *Spongiforma* (Desjardin et al. 2009); *Heliogaster* (Orihara et al. 2010); *Zangia* (Li et al. 2011); *Corneroboletus* (Zeng et al. 2012) *Sutorius*, *Harrya* e *Austrolopilus* (Halling et al. 2012a, 2012b), totalizando 44 gêneros.

Dados moleculares dão suporte à monofilia de Boletineae Singer (Binder & Bresinsky 2002, Binder & Hibbett 2006, Drehmel et al. 2008, Neves et al. 2012 e Nuhn et al. 2013). No entanto houve uma ampliação na delimitação morfológica, pois se incluiu em Boletales fungos com morfologias diversas como os ressupinados e crostosos (Coniophorineae e Tapinelineae), fungos gasteroides (Sclerodermatineae) e outros agaricoides (Hygrophoropsidaceae). Entretanto, a morfologia boletoide surge em outros clados fora de Boletineae, como é o caso de *Boletinellus*, *Gyroporus* e *Phlebopus* em Sclerodermatineae, *Gyrodon* em Paxillineae e *Suillus* em Suillineae. Da mesma forma, morfologias gasteróides e secotioides também se misturam com os boletoides no clado Boletineae, como é o caso de *Chamonixia* e *Spongiforma.*

Hibbett & Thorn (2001) sugerem que o caracter tubular do himenóforo, poderia ter surgido pelo menos cinco vezes em oito linhagens ao longo da diversificação de homobasidiomicetos, e que somente as características morfológicas não seriam suficientes para delimitar os táxons.

Muitos dos conceitos genéricos sobre os caracteres morfológicos e estudos filogenéticos referentes à Boletaceae são baseados em exemplares das regiões temperadas do hemisfério norte, sendo necessária a inclusão de espécimes tropicais e subtropicais do hemisfério sul nos estudos moleculares e filogenéticos, a fim de uma circunscrição mais completa dos táxons. Dessa maneira, torna-se imprescindível fazer levantamentos mais completos acerca do grupo.

1.3 Distribuição no mundo e no Brasil

O conhecimento sobre os fungos boletoides nas regiões tropicais e subtropicais do hemisfério sul ainda é bastante limitado, havendo escassez de dados acerca da diversidade e distribuição dos mesmos. Sendo a maioria dos registros do gênero para América do Norte, Ásia, Austrália e Europa, havendo poucos registros para África e Américas Central e do Sul (Heinemann & Goossens-Fontana 1954, Singer & Digilio 1957, 1960, Singer et al. 1983).

Uma das estimativas mais aceitas do número de espécies de fungos no planeta seria de 1,5 milhões de espécies, no entanto, apenas aproximadamente 100 mil espécies foram descritas, cerca de 7% (Hawksworth et al. 1995). Há autores que sugerem que essa diversidade ainda por ser descrita estaria concentrada nas regioes tropicais, e que em relação aos fungos boletoides, a América do Sul apresentaria uma diversidade restrita ao continente, tendo como excessão os boletoides introduzidos como é o caso do gênero *Suillus* que se desenvolvem em plantanções de *Pinus* (May 1991, Watling 2001).

No Brasil os estudos com Boletaceae ainda são muito escassos em comparação a outros países do hemisfério norte, onde o estudo com o grupo se iniciou há décadas (Neves & Capelari 2007). Padre Johannes Rick, considerado o Pai da Micologia Brasileira, realizou coletas de fungos boletoides na região sul no início do século e seus dados compilados em artigo na década de 60 (Rick 1960), onde há registro de cinco táxons de Boletales (*Boletus brasiliensis* Rick, *Boletus subtomentosus* L., *Phlebopus tropicus* (Rick) Heinem. & Rammeloo, *Phylloporus flavipes* Rick e *Phylloporus pratensis* Rick). Rolf Singer foi o primeiro a registrar a presença de fungos boletoides nas florestas baixas da Amazônia na década de oitenta, descrevendo vários novos táxons (Singer & Araújo 1979, Singer et al. 1983), e Oliveira (1987) e Oliveira & Souza (1996, 2002) identificaram oito táxons boletoides em fragmentos de Mata Atlântica no estado da Paraíba (*Boletellus lepidospora* E.-J.Gilbert ex Heinem, *Boletellus pustulatus* (Beeli) E.-J.Gilbert, *Chalciporus piperatus* (Bull. Ex Fr.) Bat., *Fistulinella violaceipora* (Stev.) Sing., *Gyrodon proximus* Sing., *Phlebopus beniensis* (Sing. & Dig.) Heinem. & Rammeloo, *Phlebopus harleyi* Heinem. & Rammeloo e *Phlebopus portentosus* (Berk. & Br) Boedijn.

Segundo a Lista de Espécies da Flora do Brasil (Neves et al. 2012), há registro de 43 táxons de Boletaceae para o Brasil, incluindo onze gêneros (*Austroboletus, Boletellus,, Boletus, Chalciporus, Fistulinella, Phyllobolites, Phylloporus, Pulveroboletus, Strobilomyces, Tylopilus* e *Xerocomus*), distribuídas nos estados da Amazônia, Paraíba, Pernambuco, Rio de Janeiro, São Paulo e Rio Grande do Sul. De acordo com a literatura consultada e os novos registros apresentados neste trabalho (marcados em negrito na tabela), há 54 táxons identificados pertencentes a Boletaceae em florestas brasileiras (Tab.1).

Tabela 1: Táxons de Boletaceae registrados para o Brasil.

TÁXONS	**UF**	**REFERÊNCIAS**
Austroboletus festivus (Singer) Wolfe	PE PR **SC**	Singer 1970, Watling & Meijer 1997, **presente estudo**
Austroboletus graciliaffinis Singer	AM	Singer 1989
Austroboletus olivaceus Singer	AM	Singer et al. 1983
Austroboletus rionegrensis (Singer & Araujo) Sing.	AM	Singer & Araújo 1979, Singer et al. 1983
Boletellus ananas (M.A.Curtis) Murrill	**AM**	Singer et al. 1983, **presente estudo**
Boletellus lepidospora E.-J.Gilbert ex Heinem.	**PB**	Oliveira 1987, **presente estudo**
Boletellus pustulatus (Beeli) E.-J.Gilbert	PB	Oliveira 1987, Oliveira & Sousa 2002,
Boletus calopus Pers (sin. *Boletus olivaceus* Schaeff. 1977)	RS	Singer 1953, Rick 1960
Boletus cinnamomeus Rick	RS	Singer 1953, Rick 1960
Boletus edulis Bull.	RS	Sobestiansky 2005
Boletus mutabilis var. *austroamericanus* Rick	RS	Rick 1960
Boletus panormitanus Inzenga	RS	Rick 1960
Boletus spadiceus Schaeff.	RS	Singer 1953
Chalciporus trinitensis var. *trinitensis* (Heinem.) Singer	AM	Singer et al. 1983
Chalciporus trinitensis* var. *amazonicus L.D. Gómez	AM **ES**	Singer et al. 1983, Goméz 1996, **presente estudo**
Chalciporus piperatus (Bull.) Bataille	PB PE SC	Oliveira & Sousa 2002, Watling & Meijer 1997, Giachini et al. 2000
Fistulinella campinaranae Singer	AM	Singer et al. 1983
Fistulinella alboaurantiaca	**BA**	**presente estudo**

Fistulinella cinereoalba	**BA**	**presente estudo**
Fistulinella condurensis	**BA**	**presente estudo**
Fistulinella rhytidocystidiata	**ES**	**presente estudo**
Fistulinella sp1	**ES**	**presente estudo**
Fistulinella violaceipora (G.Stev.) Pegler & T.W.K. Young	PB	Oliveira & Souza 2002
Phyllobolites miniatus (Rick) Singer	AM RS	Rick 1961, Singer et al. 1983
Phylloporus flavipes Rick	RS	Rick 1960
Phylloporus gymnocystis Singer	AM	Singer 1989
Phylloporus manausensis Singer	AM	Singer et al. 1983
Phylloporus pratensis Rick	RS	Rick 1960
Phylloporus aff. *rhodoxanthus* Heinem.	AM	Singer & Digilo 1960
Phylloporus viridis (Berk.) Singer	AM	Singer & Digilio 1960, Pegler 1997
Pulveroboletus duckeanus Singer	AM	Singer et al. 1983
Pulveroboletus roseamariae Singer	AM	Singer et al. 1983
Strobilomyces pauper Singer	AM	Singer et al. 1983
Tylopilus acutesquamosus Singer	AM	Singer et al. 1983
Tylopilus arenarius Singer	AM	Singer et al. 1983
Tylopilus balloui (Peck) Singer	**RN**	**presente estudo**
Tylopilus dimorphicus Magnago & Neves sp. nov.	**AM**	**presente estudo**
Tylopilus nigrostipitatus Magnago & M.A. Neves sp. nov.		
Tylopilus potamogeton Singer	AM	Singer et al. 1983
Tylopilus potamogeton var. *aquarius* Singer	AM	Singer et al. 1983
Tylopilus potamogeton var. *potamogeton* Singer	AM	Singer et al. 1983
Tylopilus pygmaeus Magnago & Neves sp. nov.	**BA**	**presente estudo**
Tylopilus versiformis Magnago & Neves sp. nov.	**PB**	**presente estudo**
Xerocomus amazonicus Singer	AM	Singer et al. 1983
Xerocomus amazonicus Singer var. *amazonicus*	AM	Singer et al. 1983
Xerocomus amazonicus var. *obscuratus* Singer & Araujo	AM	Singer et al. 1983

Xerocomus brasiliensis (Rick) Singer	RS SP	Singer & Digilo 1957
Xerocomus campinaranae Singer	AM	Singer et al. 1983
Xerocomus chapinii Singer	AM	Singer et al. 1983
Xerocomus coccolobae Pegler	PR	Watling & Meijer 1997
Xerocomus globuliger Singer	AM	Singer et al. 1983
Xerocomus hypoxanthus Singer	PE RJ	Singer & Digilio 1960, Oliveira 1987
Xerocomus inundabilis Singer	AM	Singer et al. 1983
Xerocomus radicicola Singer & I.J.Araujo	AM	Singer et al. 1983
Xerocomus scrobiculatus Singer	AM	Singer et al. 1983

1.4 Aspectos ecológicos e econômicos

Os fungos são considerados um dos principais componentes da biodiversidade global, desempenhando papéis determinantes nos ecossistemas. Assim como outros fungos, os boletoides atuam diretamente na dinâmica de várias comunidades, principalmente pelo seu papel como decompositores, degradando grandes moléculas e as disponibilizando no ambiente, possibilitando a ciclagem dos nutrientes (Peya et al. 2008). Além disto, podem atuar como simbiontes, formando associações ectomicorrízicas, onde ocorre a interação entre o micélio fúngico e as extremidades das raízes das plantas. Nessa associação a planta passa para o fungo produtos da fotossíntese e em troca o fungo aumenta a capacidade de absorção de nutrientes para a planta através do micélio, além de protegê-la contra patógenos (Agerer 1987-1991, Kothamasi 2001). Através dessa simbiose a planta hospedeira passa a ter uma maior chance de sobrevivência e crescimento, fato que contribui para o equilíbrio das comunidades vegetais e dos processos de reflorestamento (Read 1999).

Aproximadamente 90% dos representantes de Boletaceae formam ectomicorrizas, representando 18% a 25% de todos os fungos ectomicorrízicos conhecidos (Agerer 1987-1991, Hawksworth et al. 1995). Entre as famílias de plantas conhecidas que estabelecem esse tipo de associação estão Betulaceae Gray, Casuarinaceae R. Br., Dipterocarpaceae Blume, Ericaceae Juss. , Fabaceae Lindl. (Caesalpinoideae, Mimosoideae), Fagaceae Dumort., Myrtaceae Juss., Nyctaginaceae Juss., Pinaceae Spreng. ex Rudolphi e Salicaceae Mirb.(Brundrett 2002, Henkel 2002, Haug et al. 2005, Vellinga et al. 2009).

Além do papel ecológico, várias espécies de Boletaceae são economicamente importantes devido ao seu valor na culinária (p.ex. *Boletus edulis* Bull., conhecido popularmente como *porcini*; espécies de *Suillus* Gray

(Suillaceae) e popularmente conhecidas como *funghi secchi*; entre outras espécies como *Boletellus ananas* (Curt.) Murr., *Boletus pallidus* Frost, *Harrya chromapes* (Frost) Halling, Nuhn, Osmundson & Manfr. Binder, *Retinoboletus ornatipes* (Peck) Manfr. Binder & Bresinsky, *Tylopilus balloui* (Peck) Singer e *Tylopilus indecisus* (Peck) Murrill (Smith & Thiers 1971, Henkel et al. 2004, Taveira & Novaes 2007).

2. OBJETIVOS

O objetivo principal do presente trabalho foi ampliar o conhecimento da diversidade de Boletaceae nas florestas brasileiras, através de uma abordagem taxonômica e sistemática, realizando um levantamento bibliográfico, estudo de materiais de herbários, realização de novas coletas e identificação e registro de novas espécies.

3. METODOLOGIA

3.1 Áreas de coleta

As áreas de estudo abrangem dois biomas, Floresta Amazônica e Mata Atlântica. As coletas foram realizadas em trilhas nas seguintes localidades (Tab. 2), em períodos de alta pluviosidade. As coletas tiveram apoio ou foram realizadas por colegas, incluindo Ariadne N.M. Furtado, Carlos A. S. Montoya, Diogo H.C. Rezende, Dirce L. Komura, Maria A. Neves e Elisandro R. Drechsler-Santos.

Tabela 2: Localidades de coletas.

Localidade	**Cidade**	**UF**	**Coordenadas**	**Bioma**
Ramal do Novo Amanhecer, Canal do Tarumãzinho	Mamaus	AM	02°50'50"S, 60°14'08"W	Floresta Amazônica
Parque das Dunas	Natal	RN	05°51'S, 35°11'W	Mata Atlântica (restinga)
Rebio Guaribas	Mamanguape	PB	06°44'14"S, 35°8'55"W	Mata Atlântica (tabuleiro)
UFPB	João Pessoa	PB	07°08'18.20"S, 34°50'49.37"W	Mata Atlântica
Parque Estadual da Serra do Conduru	Itacaré	BA	14°24' 39°04'	Mata Atlântica
Rebio Augusto Ruschi	Santa Teresa	ES	19°54'19.60"S, 40°34'8.20"W	Mata Atlântica

Parque Municipal das Dunas da Lagoa da Conceição	Florianópolis	27°36'46.22"S, 48°27'10.45"W	Mata Atlântica (restinga)

3.2 Análises morfológicas

Os basidiomas foram fotografados no local de coleta ainda frescos. Quando possível foram realizados testes químicos com Hidróxido de Potássio (KOH3%) e Hidróxido de Amônio (NH_4OH) na superfície e no contexto do basidioma fresco preferencialmente (Singer 1986).

Para as descrições macroscópicas seguiu-se a metodologia e nomenclatura de Largent (1986). Os códigos de cores (ex. OAC 566), seguiu a Tabela de cores *Online Auction Color Chart* (Kramer 2004). Após, os materiais foram desidratados em uma secadora de frutas (Total Chef TCFD-05 Deluxe) durante um período de aproximadamente 24 horas ou até a completa desidratação dos basidiomas. Geralmente devido aos basidiomas serem robustos é necessário seccionar os espécimes em fatias para melhor desidratação.

Após desidratados no Laboratório de Micologia (MICOLAB-UFSC), foram realizadas as descrições microscópicas em Microscópio Óptico (*Olympus* CX21), seguindo a metodologia e nomemclatura de Largent et al. (1977), realizando lâmilas semipermanetes em água, KOH, Vermelho Congo ou Reagente de Melzer, onde um total de 20 elementos foram medidos de cada estrutura, como esporos, basídios, cistídios, hifas da trama, pileipelis e estipipelis. Q_m se refere a média do Quociente da medida comprimento/largura dos esporos.

As análises de Microscopia Eletrônica de Varredura (MEV) foram realizadas no Laboratório Central de Microscopia Eletrônica da UFSC (LCME-UFSC), onde foi retirado fragmentos do himenóforo e montados sobre uma fita adesiva de carbono em *stubs* de alumínio e banhados por uma camada de 30 nm de ouro, e observados em Micorscópio Eletrônico de Varredura a 10KeV.

Os desenhos foram realizados a mão livre a partir de imagens digitais dos materiais em estudo.

Os exemplares foram depositados nos Herbários FLOR (Universidade Federal de Santa Catarina, SC), HUEFS (Universidade Estadual de Feira de Santana, BA) e no INPA (Instituto Nacional de Pesquisas da Amazônia).

3.3 Classificação taxonômica adotada

Neste trabalho foram considerados os fungos boletoides (que apresentam píleo, estipe e himenóforo tubular), incluídos em Boletaceae de acordo com *Ainsworth & Bisby´s Dictionay of Fungi 10th edition* (Kirk et al. 2008). Onde Boletaceae compreende 35 gêneros, sendo 21 boletoides (*Afroboletus* Pegler & T.W.K. Young, *Aureoboletus* Pouzar, *Austroboletus* (Corner) Wolfe, *Boletus* Dill. ex Fr., *Boletellus* Murr., *Boletochaete* Sing., *Bothia* Halling, T.J. Baroni & Manfr. Binder, *Chalciporus* Bat., *Fistulinella* Henn., *Heimioporus* E. Horak, *Leccinum* S.F. Gray, *Leccinellum* Bresinsky & Manfr. Binder *Phyllobolites*

Singer, *Porphyrellus* Gilbert, *Pulveroboletus* Murr., *Strobilomyces* Berk., *Tubosaeta* E. Horak, *Tylopilus* Karst., *Veloporphyrellus* Gomez & Sing., *Xanthoconium* Sing., *Xerocomus* Quel.) e os demais gasteróides e agaricóides.

4. RESULTADOS

Foram identificados 30 espécimes referentes a 14 táxons, distribuídos em cinco gêneros (*Austroboletus* (Corner) Wolfe, *Boletellus* Murrill, *Chalciporus* Bataille, *Fistulinella* Henn. e *Tylopilus* P. Karst.). Abaixo (Tab. 3) a lista dos táxons, com os números de coletores, o Estado (UF) e a formação vegetacional do local de coleta.

Tabela 3: Táxons identificados durante o período de trabalho.

Táxons	**N°de coletor**	**UF**	**Vegetação**
Austroboletus festivus	ACM564 ACM573 ACM574 ACM575 ACM 847	SC	Restinga/ Dunas
Boletellus ananas	DLK380	AM	Ombrófila densa
Boletellus cf. *lepidospora*	MAN481 MAN502	PB	Ombrófila densa (área de Tabuleiro)
Chalciporus trinitensis var. *amazonicus*	ACM492 ACM528 ACM529	ES	Ombrófila densa
Fistulinella alboaurantiaca	MAN185	BA	Ombrófila densa
Fistulinella cinereoalba	ACM484	BA	Ombrófila densa
Fistulinella conduruensis	ACM485	BA	Ombrófila densa
Fistulinella rhytidocystidiata	ACM526	ES	Ombrófila densa
Fistulinella sp.1	ACM491	ES	Ombrófila densa
Tylopilus balloui	MAN215 MAN216 MAN218 MAN255 MAN256 MAN258 MAN281	RN	Restinga/ Dunas
Tylopilus dimorphicus	DLK382	AM	Ombrófila densa

Tylopilus nigrostipitatus	MAN389	PB	Ombrófila densa
Tylopilus pygmaeus	ACM486	BA	Ombrófila densa
Tylopilus versiformes	MAN460 ACM269 ACM296 ACM297	PB	Ombrófila densa (área de Tabuleiro)

Alguns táxons identificados foram compilados em artigos/nota científica e divididos em capítulos e estes formatados de acordo com as normas das revistas sugeridas:

Capítulo I: Artigo - New taxa and distribution records of *Tylopilus* (Boletaceae) from Brazil (*Mycotaxon* – B1 Biodiversidade).

Capítulo II: Artigo - New species of *Fistulinella* (Boletaceae) from Atlantic Forest, and first record of *Fistulinella cinereoaba* for Brazil (*Nova Hedwigia* – B1 Biodiversidade).

Capítulo III: (Aceito) Nota científica - New record of *Austroboletus festivus* (Boletaceae) from Santa Catarina, Brazil (*Brazilian Journal of Botany* DOI: 10.1007/s40415-014-0048-3 – B3 Biodiversidade).

Capítulo IV: É apresentado os táxons que não foram incluídos nos capítulos anteriores na forma de artigos: duas espécies de *Boletellus,* uma de *Chalciporus* e uma de *Fistulinella.*

4.1 **CAPÍTULO I:** Artigo

New taxa and distribution records of *Tylopilus* (Boletaceae) from Brazil

Altielys Casale Magnago, Dirce Leimi Komura & Maria Alice Neves

***Artigo a ser submetido para publicação na revista *Mycotaxon*.**

New taxa and distribution records of *Tylopilus* (Boletaceae) from Brazil

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Abstract – Four species of *Tylopilus* are described as new from Brazil. *Tylopilus balloui* is registered for the first time for Brazil. The specimens were collected in Tropical Brazilian Forests during the rainy season. A key to the species of Tylopilus registered from Brazil is provided. Photographs of the basidiomes, microscopic illustrations and Scanning Electron Microscopy of the basidiospores are presented for each species.

Key words – Agaricomycetes, Boletales, Neotropics, systematic.

Introduction

Tylopilus P. Karst (1881) is a widespread ectomycorhizal genus in Boletaceae, known from Australia, Asia, Europe and Americas (Karsten 1881, Heinemann & Goossens-Fontana 1954, Heinemann 1964, Smith & Thiers 1971, Wolfe 1981, Singer et al. 1983, 1991, Wolfe & Bougher 1993, Watling & Turnbull 1994, Nagasawa 1997, Henkell 1999, Watling & Tai-Hui 1999, Henkell 2001, Chen 2004, Takahashi 2002, 2007, Palfer 2005, Ortiz-Santana et al. 2007, Fulgenzi et al. 2007, Kirk et al. 2008, Halling et al. 2008, Osmoundson & Halling 2010). The traditional morphological concept of *Tylopilus* includes species with stipe with or without reticulum, pore surface usually whitish colored when young becoming pinkish with age, and spore print pink to pinkish brown, never with olivaceous hues (Smith & Thiers 1971, Singer et al. 1983, Nuhn et al. 2013). The basidiospores are smooth and short to elongate (Q_m<3.0).

About twenty species of *Tylopilus* have been described for the Neotropics including Colombia (Halling 1989), Belize (Halling et al. 2008), Costa Rica (Singer et al. 1983, Wolfe & Bougher 1993, Amtoft et al. 2002, Halling et al. 2008, Osmundson & Halling 2010), Guyana (Henkel 1999, 2001, Fulgenzi et al. 2007), Honduras, Mexico, Nicaragua (Singer et al. 1983), and Venezuela (Singer & Digilo 1960). For Brazil there are three known species and two varieties described by Singer et al. (1983) from the

Amazon forest in *igapó* and *campinarana* areas (*T. acutesquamosus* Singer, *T. arenarius* Singer, *T. potamogeton* var. *aquarius* Singer, *T. potamogeton* var. *potamogeton* Singer). In this paper we describe four new species and register the first occurrence of *Tylopilus balloui* (Peck) Sing. for Brazil.

Material and methods

The collections were made between 2008 and 2013 during rainy seasons. Most collections are from the Atlantic Forest: Universidade Federal da Paraíba - PB (7°8'18.20"S, 34°50'49.37"W), Reserva Biológica Guaribas - PB (6°44'14"S, 35°8'55"W), Parque das Dunas - RN (5°51'S, 35°11'W); and Parque Estadual da Serra do Conduru - BA; and there is collection also from the Amazon Forest at Ramal do Novo Amanhecer, Canal do Tarumãzinho – AM (2°50'50"S, 60°14'08"W)).

Macroscopic features were described from fresh basidioma. Color codes (e.g. OAC 640) were based on the Online Auction Color Chart (Kramer 2004). Macrochemical tests were performed, when possible, according to Singer (1986). Micro morphological features were examined with an Olympus CX21 microscope and the use of descriptive terms follows Largent et al. (1977). Fungal tissue was rehydrated and mounted in water, potassium hydroxide 3%, Melzer's solution or Congo Red. At least twenty micro structures were measured for each collection examined. Q_m refer to the Quocient average length/width ratio range from the basidiospores. For scanning electron microscopy (SEM) of the basidiospores, fragments of the hymenophore were removed from dried basidiomes, mounted directly on aluminum stubs using carbon adhesive tabs, and coated with 30 nm of gold, and examined with a scanning electron microscope operating at 10KeV at Laboratório Central de Microscopia Eletrônica da Univercidade Federal de Santa Catarina (LCME-UFSC). The fragments were examined with a scanning electron microscope operating at 10KeV. Line drawings were traced from digital photographs. Voucher materials were deposited at FLOR, HUEFS, or INPA according to collection sites (Thiers, continuously updated).

Taxonomy

Tylopilus balloui (Peck) Singer [as '*ballouii*'], American Midland Naturalist 37: 104 (1947).

(FIGS 1,6AB)

= *Boletus balloui* Peck 1912

PILEUS 25−115 mm broad, at first convex, with age becoming plano-convex to plano-depressed, yellow orange (OAC 789), to orange (OAC 644) with red tones (OAC 670), finely velutinous under lens, dry, margin slightly inrolled and entire; context 5−14 mm, whitish to yellowish (OAC 815), unchanging. TUBES 4−13 mm long, whitish to cream (OAC 816), slightly decurrent; pores 1−2 mm broad, isodiametric, whitish, staining light orange brown upon pressure. STIPE 30−65 mm × 8−28 mm centrally to eccentrically, subequal,

whitish to cream yellow (OAC 814); smooth, context cream (OAC 815), unchanging; extreme base with white mycelium.
BASIDIOSPORES 6−9 x 3−4 µm (Q_m=1.91), ellipsoid to elongate, the inner side applanate, some bean shaped, in mass light yellow, inamyloid to weakly dextrinoid, smooth, thin walled; hilar appendage 0.5−1 µm long. BASIDIA 27−40 x 6−10 µm, clavate, thin walled, hyaline, many with granular contents; 4-sterigmate, 4−6 µm long. CYSTIDIA on edges and sides similar in size and shape, 32−82 x 6−13 µm, fusoid, ventricose, clavate, hyaline, some dextrinoid. HYMENOPHORAL *trama* boletoid in a gelatinized matrix, mediostratum of subparallel to interwoven hyphae, 3−5 µm wide, lateral stratum hyphae 5−8 µm wide, inamyloid. PILEIPELLIS trichodermium, interwoven in a gelatinized matrix, hyphae 2−5 µm wide, light brown with gold brown contents, dextrinoid, hyphae regularly septate. PILEUS TRAMA interwoven to subparallel, partly gelatinized, light yellow, with dextrinoid contents. STIPITIPELLIS in two layers, first layer hymeniform, with terminal cells 4−9 µm wide, light brown in H_2O; presence of caulobasidia and caulocystidia in variables shapes, like clavate, cylindrical, fusoid, ventricose, capitate; lower layer with narrows hyphae with gold brown contents in H_2O, 2−4 µm wide, interwoven vertically arranged in gelatinized matrix. STIPE TRAMA parallel to subparallel, hyphae 4−15 µm broad, hyaline, inamyloid, smooth and thin wall. CLAMP CONNECTION absent. MACROCHEMICAL REACTIONS: NH_4OH on surfaces unchanging, when test was made on dry specimens. SPORE PRINT pinkish.

HABIT, HABITAT AND DISTRIBUTION − Solitary, scattered or caespitose on white sand soil on dunes. In Brazil known only from Rio Grande do Norte (present study), also known to Australia, Belize, Costa Rica, Mexico, United States of America and Thailand (Halling et al. 2008).

SPECIMENS EXAMINED − BRAZIL. RIO GRANDE DO NORTE: Natal, Parque das Dunas. 5°51'S, 35°11'W, 29 Apr 2008, *Neves, M.A. 255, 256, 258* (HUEFS); 24 Apr 2008, *Neves, M.A. 215, 216, 218* (HUEFS, FLOR); 24 May 2008, *Neves, M.A. 281* (HUEFS).

ADDITIONAL SPECIMENS EXAMINED: AUSTRALIA. QUEENSLAND: *Tylopilus balloui*. Fraser Island, road from Central Station to Eurong. 25°29’6’’S, 153°5’18’’E, 11 Feb 2009, Halling, R.E. 9053 (NY). BELIZE. CAYO DISTRICT. *Tylopilus balloui.* Mountain Pine Ridge: Douglas Da Silva, British Military Swamp. 16°58’9’’N, 88°59’38’’E, 6 Oct 2003. Halling, R.E. 8526 (NY). COSTA RICA. CARTAGO. *Tylopilus oradivensis.* Guarco, palo Verde. +/_ 4.5 km E of km 31 of Interamerican Highway. 9°46’34’’N, 83°56’42’’W. 1 June 2001. Halling, R.E. 8087 (NY).

COMMENTARY − These collections constitute the first record of *T. balloui* from Brazil. *Tylopilus balloui* is a distinctive bolete, easily recognized in the field by the yellow-orange to orange-red pileus, white to cream hymenophore, cream to pale yellow stipe and unchanging reaction with ammonium. The short dimensions of the spores and the trichodermium

pileipellis are another microscopic distinguishing features. The Brazilian specimens described here agree with the description of *T. balloui* from Guiana by Henkel (1999). Halling et al. (2008) commented that the widespread distribution of *T. balloui*, combined with morphological characteristics and genetics differences, suggest that *T. balloui*, as currently circumscribed, represents a species complex rather than a single species.

Tylopilus dimorphicus Magnago & M.A. Neves **sp. nov.** *ad. int.*
(FIGS 2, 6CD)

DIAGNOSIS: Pileus grayish pink to lilac, with dark fibrils throughout; tubes pink; stipe brown with apex cream, with black reticulation, stipe context bluing on the upper two third when exposed; basidiospores dimorphics, ellipsoid to oblong, and cylindric to bacciliform; basidia dimorphic, 1 or 4-spores; cystidia fusoid to ventricose; pileipellis trichodermium; stipitipelis with caulocystidia ventricose-rostrate to clavate.
ETIMOLOGY*:* from the Latin *dimorphicus* = with two shapes; referring to the dimorphism of the basidia and basidiospores.

TYPE: BRAZIL, AMAZONAS: Manaus, Ramal do Novo Amanhecer, Canal do Tarumãzinho. 2°50’50’’S, 60°14’08’’W, 27 Apr 2012, Komura, D.L. 382 (**HOLOTYPE, INPA**).

PILEUS 55 mm broad, convex to slightly sinuate, grayish pink to lilac (OAC 513), with dark almost black finely fibrils throughout the pileus, dry, margin slightly uplifted and entire; context 3−14 mm, cream (OAC 794), unchanging. TUBES 4−15 mm long centrally, depressed around stipe, pink (OAC 522); tube mouths whitish to light pink (OAC 795); pores 1−2 mm broad, unchanging. STIPE 70 × 10−12 mm, centrally, subequal, tapering gradually upward, brown (OAC 733), apex cream (OAC 806); reticulate, reticulum blackish, context cream, weakling bluing on the upper two third when exposed; base with white mycelium.
BASIDIOSPORES dimorphic, the majority 9−10 x 5−6 µm (Q_m=1.68), ellipsoid to oblong, the inner side slightly applanate to slightly concave, the minority 13−19 x 5−6 µm (Q=3.09), cylindric to fusiform, both hyaline, inamyloid, smooth, guttulate, hilar appendage 0.5−1 µm long. BASIDIA 25−33 x 10−12 µm, clavate, thin walled, hyaline, inamyloid, with granulations, 1 or 4-spores; sterigmate, 4−6 µm long. CYSTIDIA 29−44 x 5−9 µm, fusoid to ventricose, frequent, hyaline, inamyloid. HYMENOPHORAL TRAMA boletoid in gelatinized matrix, mediostratum subparallel, hyphae 3−4 µm wide, lateral stratum hyphae 5−9 µm wide, inamyloid, smooth. PILEIPELLIS trichodermium, terminal hyphae tapering at the apex, 61−90 x 6−9 µm, light reddish brown with dark granulations in H_2O; weakly bluing in 3% KOH, losing the granulations; dextrinoid; oleiferous hyahae present. PILEUS TRAMA interwoven to subparallel, light yellow, with dextrinoid granular contents.

STIPITIPELIS in two layers, first layer with caulocystidia frequent, ventricose-rostrate, clavate, 30−42 x 6−8 µm wide, light brown, caulobasidia present; second layer with narrows interwoven hyphae 2−4 µm, in a gelatinized matrix. STIPE TRAMA with parallel to subparallel hyphae, 4−17 µm broad, hyaline, inamyloid. CLAMP CONNECTION absent. MACROCHEMICAL REACTIONS: NH_4OH on pileus and stipe strongly bluing, the test was made on dry specimens. SPORE PRINT pinkish.

HABIT, HABITAT AND DISTRIBUTION − Solitary on soil under trees, in tropical Amazon *campinarana*, known only from the type locality.

ADDITIONAL SPECIMENS EXAMINED − BRAZIL. AMAZONAS: *Tylopilus aculeatus* Sing., Estrada Manaus-Caracaraí, km 45, 12 Jan 1979, Singer B 11484 (INPA); *Tylopilus potomogeton* var. *aquarius* Sing. Igarapé do Tarumãzinho, 14 Dec 1978, Singer B 11433 (HOLOTYPE, INPA).

COMMENTARY − The material examined is very close to *T. acutesquamulosus* Singer, that is characterized in the field by the blackish fibrils over the grayish pink pileus and the reticulated stipe (Singer et al. 1983). In the description of *T. acutesquamulosus*, Singer cites a reddish reaction on the hymenophore and in the context of the stipe when exposed, this reaction was not observed in the specimen we studied. *Tylopilus dimorphicus* presents dimorphic basidiospores, the majority ellipsoid to oblong measuring 9−10 x 5−6 µm (Q=1.68), and the minority cylindric to bacciliform measuring 13−19 x 5−6 µm (Q=3.09) and basidia with 1 or 4 spores, characteristics that were not cited for *T. acutesquamulosus*. However it was not possible to examine the type of *T. acutesquamulous* because the collection (R.Singer B11483) was not found at INPA.

Tylopilus potamogeton var. *aquarius* is also described by having two sizes of basidiospores (8)9−11.5 x (5)5.5−7.5 µm (majority) and 11−16 x 5−6 µm (minority) (Singer et al. 1983), but analyzing the *typus*, these characteristics were not so evident, and the other macro and microscopic characteristis do not match *T. dimorphicus.*

Tylopilus aculeatus (unpublished – INPA 82381/ R.Singer B11484) was collected in 1979, in the Amazon forest and was studied to compare to our specimen. However, the dried exsiccate of *T. aculeatus* presents the pileus surface composed by pyramidal squarrose scales that are very prominent in the center, becoming less evident towards the margin and do not look like the fibrils present on the surface pileus of *T. dimorphicus*. *Tylopilus aculeatus* also differs from *T. dimorphicus* on the basidiospores that are fusiform and not dimorphic, and on the cystidia that are versiform with strongly dextrinoid contents.

Tylopilus nigrostipitatus Magnago & M.A. Neves **sp. nov.** *ad. int.*

(FIGS 3, 6EF)

DIAGNOSIS: Pileus pinkish with brownish center, convex to plano depressed, surface velvet with small cracked areas; tubes pink, depressed around stipe; stipe dark gray to black, lighter at the apex; with a whitish pruina throughout; pleurocystidia narrowly fusoid to slightly ventricose; cheilocystidia broadly cylindrical to fusoid, septate; pileipellis trichodermal palisade of catenulate hyphae.

ETIMOLOGY: from the Latin *nigrostipitatus* = with darkened stipe; referring to the dark almost black colored stipe.

TYPE: BRAZIL, PARAÍBA: João Pessoa, Universidade Federal da Paraíba, Mata da Biblioteca. 7°8'18.20"S, 34°50'49.37"W. 12 Mar 2009, *Neves, M.A. 389* (**HOLOTYPE, FLOR**).

PILEUS 17−26 mm broad, convex to plano depressed with age, pinkish (OAC 682) with brownish center (OAC 659), surface velvet with small cracked areas near the margin, dry; margin entire. TUBES 5−7 mm long centrally, depressed around stipe, pink (OAC 634); tube mouths pinkish (OAC 633); pores 1−2 mm broad, unchanging. STIPE 28−35 × 6−9 mm, centrally, tapering gradually upward, surface dark gray to black (OAC 901), lighter at the apex; with a whitish pruina throughout easily removed when brushed; context whitish to cream.

BASIDIOSPORES 8–10 x 4–5 µm (Q_m=1.95), ellipsoid to oblong, hyaline, inamyloid, thick walled. BASIDIA 24–32 x 8–10 µm, clavate, thin walled, hyaline, inamyloid; 4-sterigmate, 3–6 µm long. PLEUROCYSTIDIA 68–85 x 9–13 µm, narrowly fusoid to slightly ventricose, hyaline, thin walled, scattered. CHEILOCYSTIDIA 49−66 x 8−11 µm, broadly cylindrical to fusoid, septate (1−2), hyaline. HYMENOPHORAL TRAMA parallel to subparallel, hyphae 4–9 µm wide, hyaline to light yellow, inamyloid, thin walled. PILEIPELLIS a trichodermal palisade of catenulate hyphae, terminal cells tapering to the apex or clavate, 12–19 x 8–10 µm, light brown, inamyloid. PILEUS TRAMA interwoven, hyphae 5–12 µm wide, light yellow. STIPITIPELLIS repent, with clusters of projecting cylindrical to subclavate hyphae, brownish; terminal cells 4–7 µm wide, caulobasidia present. STIPE TRAMA parallel to subparallel, hyphae 3-10 µm wide, light brown, inamyloid. CLAMP CONNECTIONS absent. MACROCHEMICAL REACTIONS − NH_4OH on surfaces unchanging, when test was made on dry specimens. SPORE PRINT pinkish.

HABIT, HABITAT AND DISTRIBUTION − Growing on soil under trees, in Atlantic forest, known only from the type locality.

COMMENTARY − *Tylopilus nigrostipitatus* is characterized in the field by the pinkish pileus with brown tones, the pink hymenophore, pores 1–2 mm broad, and dark gray to black stipe with a whitish pruina. Microscopically is distinguished by the broadly septate cheilocystidia, narrowly fusoid and

scattered pleurocystidia, and pileipellis formed by a trichodermal palisade of catenulate hyphae.

This species is very similar to *T. vinosobrunneus* Hongo (Chen et al. 2004), but macroscopically they differ in the overall color of the basidomes and in the hymenophore. The pileus of *T. vinosobrunneus* is purple-brown to vinaceous-brown when young, orange-brown to black when old; the tubes are wood-brown or darker; and the stipe surface is vinaceous-brown to purple-brown, with a reticulated apex. The pores of *T. vinosobrunneus* are smaller (2–3 per mm) when compared to the pores in *T. nigrostipitatus* (1–2 per mm). Microscopically *T. nigrostipitatus* resembles *T. neofelleus* Hongo, however the later has broader ventricose pleurocystidia, larger basidiospores (11–14 × 4–5 μm), and shorter ventricose cheilocystidia without septa and with an obtuse apex (Chen et al. 2004).

Tylopilus pygmaeus Magnago & M.A. Neves **sp. nov.** *ad. int.*

(FIGS 4, 7AB)

DIAGNOSIS: Pileus parabolic to plano-convex with age, brown to tannish brown, velutinous, becoming dark brown when bruised; tubes withish, adnate, slightly depressed around stipe, staining light brown under pressure; basidiospores ellipsoid; cystidia ventricose-rostrate to versiform, the majority with golden brown contents, strongly dextrinoid; pileipellis trichodermium which many terminal hyphae differentiated like cystidia, with golden brown contents, dextrinoid.
ETIMOLOGY: from the Latin *pygmaeus* = *small, short*; referring to the small size of the basidiomes.

TYPE: BRAZIL, BAHIA: Itacaré, Parque Estadual da Serra do Conduru, 30 Nov 2012, Col. DHC Rezende & CAS Montoya, *Magnago, A.C. 486* (**HOLOTYPE FLOR**).

PILEUS 11−26 mm broad, at first parabolic, becoming plano-convex with age, brown (OAC 638) to tannish brown (OAC 721), velutinous, dry, becoming dark brown when bruised, margin slightly inrolled and entire when young; context 3−7 mm, cream (OAC 683). TUBES 3−6 mm long, adnate, slightly depressed around stipe, whitish; pores 3−4 per mm, angular, staining light brown under pressure. STIPE 22−35 × 4−8 mm, centrally, sub-equal, glabrous to velvet, cream to light pinkish brown; context cream (OAC 683); extreme base with white mycelium.
BASIDIOSPORES 7−9 x 4−5 μm (Q_m=1.69), ellipsoid, the inner side applanate, hyaline, inamyloid, smooth, thin walled, hilar appendage 0.5−1 μm long. BASIDIA 25−35 x 8−10 μm, clavate, thin walled, hyaline, inamyloid; 4-sterigmate, 3−4 μm long. CYSTIDIA on edges and sides not differentiated from each other, very frequent and not or little projecting, 24−39 x 8−11 μm, ventricose-rostrate to versiform, the majority with golden brown contents,

strongly dextrinoid and some hyaline without contents. HYMENOPHORAL TRAMA boletoid in gelatinized matrix, mediostratum of many narrow parallel to interwoven hyphae, 3−5 µm wide, these yellow to light yellow, lateral stratum hyphae 3−11 µm wide, hyaline, strongly divergent. PILEIPELLIS trichodermium consisting of erect to sub erect terminal hyphae which many are differentiated like cystidia, with golden brown contents, dextrinoid, terminal hyphae 28−73 x 8−10 µm. *Pileus trama* interwoven; hyphae 4−6 µm wide, light yellow, some with granular dextrinoid contents. STIPITIPELLIS hymeniform, terminal hyphae 23−42 x 7−11 µm, versiform, clavate, ventricose, golden brown, strongly dextrinoid; caulobasidia present. STIPE TRAMA subparallel to interwoven hyphae, vertically arranged, hyphae 3−10 µm wide, light yellow. CLAMP CONNECTIONS absent. MACROCHEMICAL REACTIONS: NH_4OH on surfaces unchanging, when test was made on dry specimens.. SPORE PRINT pinkish.

HABIT, HABITAT AND DISTRIBUTION − Several basidiomes on soil under trees, in Atlantic forest, known only from the type locality.

ADDITIONAL SPECIMENS EXAMINED − BRAZIL. AMAZONAS: *Tylopilus arenarius* Sing. Estrada Manaus-Caracaraí, km 45, 3 Feb 1978, Singer B10590 (HOLOTYPE, INPA); *Tylopilus potomogeton* Sing. Rio Negro, 20 km ca. de São Gabriel da Cachoeira, 20 Jan 1978, Araujo, I. 938 (PARATYPE, INPA); *Tylopilus potomogeton* var. *aquarius* Sing. Igarapé do Tarumãzinho, 14 Dec 1978, Singer B 11433 (HOLOTYPE, INPA).

COMMENTARY: Both *T. pygmaeus* and *T. potamogeton* var. *potamogenton* Singer have small basidiomes, velutinous brownish pileus that are up to 36 mm broad, whitish hymenophore and stipe cream pinkisk with brown tones (Singer et al. 1983). Microscopically, however *T. potamogeton* var. *potamogeton* has longer basidiospores (9−12 x 6−8 µm), fusoid and often mucronate hyaline cystidia, and trichodermal pileipellis.

Tylopilus pygmaeus is also similar to *T. potamogeton* var. *aquarius* Singer by the arrangement and appearance of the cystidia, the pileipellis and the stipitipellis (Singer et al. 1983). However the two sizes of the basidiospores described in *Tylopilus potamogeton* var. *aquarius* were not observed in *T. pygmaeus*. Macroscopically *T. pygmaeus* has smaller pores on the hymenophore that react brown when bruised. The browning of the hymenophore is also reported in *T. potamogeton* var. *irengensis* Henkel from Guyana (Henkel 1999), but its morphology is very different from *T. pygmaeus*.

Tylopilus versiformis Magnago & M.A. Neves **sp. nov.** *ad. int.*

FIG. 5, 7CD

DIAGNOSIS: On sandy soil; pileus convex to plano-depressed, brown to tannish brown, velutinous,; tubes adnate to slightly depressed, cream to pinkish, staining light orange-tan when bruised; stipe cream pinkish, finely light brown reticulation; basidiospores ellipsoid to phaseoliform; pleurocystidia diverticulate to versiform, with strongly dextrinoid contents;

cheilocystidia subclavate to cylindrical with variable endings; pileipellis trichodermium, golden brown, with dextrinoid granular contents.

ETIMOLOGY: from the Latin *versiformis* = of different shapes; referring to the pleurocystidia with variable shapes and cheilocystidia with various endings.

TYPE: BRAZIL, PARAÍBA: Mamanguape, Reserva Biológica Guaribas, SEMA II. 6°44'14"S, 35°8'55"W, 18 July 2009, *Neves, M.A. 460* (FLOR); 15 May 2011, *Magnago, A.C.* 269 (ISOTYOPE FLOR); 27 May 2011, *Magnago, A.C. 296* (HOLOTYPE FLOR), *297* (ISOTYPE FLOR).

PILEUS 60−92 mm broad, at first convex, with age plano-convex to plane or plano-depressed, brown (OAC 640) to tannish brown (OAC 722), velutinous, dry, becoming dark brown when bruised; margin slightly inrolled and entire; context 5−13 mm, whitish to cream (OAC 683), unchanging. TUBES 6−15 mm long, adnate to slightly depressed, cream to pinkish (OAC 676); tube mouths cream (OAC 683); pores 1−2 per mm, angular, staining light orange-tan when bruised. STIPE 60−90 mm × 8−16 mm, centrally, tapering gradually upward, cream pinkish throughout (OAC 683); extreme apex lighter, finely reticulated, reticulum light brown (OAC 668), less pronounced downwards, context cream (OAC 683), unchanging; base slightly tomentose, extreme base with white mycelium.

BASIDIOSPORES 9−11 x 5−7 µm (Q_m=1.55), ellipsoid to phaseoliform, the inner side applanate or merely concave, faint pink, inamyloid, smooth, thin walled, hilar appendage 0.8−1 µm long. BASIDIA 27−32 x 8−9 µm, clavate, thin walled, hyaline, inamyloid; 4-sterigmate, 2−3 µm long. PLEUROCYSTIDIA 26−37 x 7−9 µm, frequent, diverticulate to versiform, hyaline, with internal strongly dextrinoid contents. CHEILOCYSTIDIA 24−35 x 5−6 µm, frequent, subclavate to cylindrical with variable endings, like spiral, hook, bifurcate and sinuous, hyaline, inamyloid. HYMENOPHORAL TRAMA boletoid in gelatinized matrix, mediostratum of many narrow parallel to interwoven hyphae, 4−5 µm wide, these yellow to light yellow, lateral stratum hyphae 5−8 µm wide, hyaline, strongly divergent. PILEIPELLIS trichodermium, golden brown, with dextrinoid granular contents; terminal hyphae 3−4 µm wide, cylindrical, rounded ends. PILEUS TRAMA interwoven; hyphae 3−6 µm wide, thin walled, light yellow. STIPITIPELLIS repent with clusters of caulobasidia and golden brown caulocystidia, strongly dextrinoid. STIPE TRAMA subparallel to interwoven hyphae, vertically arranged, hyphae 3−5 µm wide, hyaline. CLAMP CONNECTIONS absent. MACROCHEMICAL REACTIONS: NH_4OH on pileus bluing and weakly bluing on stipe, the test was made on dry specimens. SPORE PRINT pinkish.

HABIT, HABITAT AND DISTRIBUTION − Solitary to scattered on white sandy soil under trees, at *tabuleiro* area in Atlantic forest, known only from the type locality.

ADDITIONAL SPECIMENS EXAMINED − BRAZIL. AMAZONAS: *Tylopilus arenarius* Sing. Estrada Manaus-Caracaraí, km 45, 3 Feb 1978, Singer B10590 (HOLOTYPE, INPA); *Tylopilus potomogeton* Sing. Rio Negro, 20 km ca. de São Gabriel da Cachoeira, 20 Jan 1978, Araujo, I. 938 (PARATYPE, INPA); *Tylopilus potomogeton* var. *aquarius* Sing. Igarapé do Tarumãzinho, 14 Dec 1978, Singer B 11433 (HOLOTYPE, INPA).

COMMENTARY − *Tylopilus versiformis* fits better in section *Potamogetones* proposed by Singer (1978) due to the combination of the bluing reaction on the pileus and stipe with ammonia and the broadly short spores (Qm= 1.5−1.8), however shows the reticulation of the stipe, characteristic of section *Arenarii* (Singer 1986). *Tylopilus versiformis* resembles *T. potamogeton* var. *irengensis* from Guiana (Henkel 1999) because of the size and color of the basidiome and the orange-tan staining of the hymenophore when bruised, however *T. versiformis* has a finely light brown reticulation on the stipe, browning on pileus surface when bruised and unchanging context when exposed. It is also similar to *T. arenarius*, differing from it by the size of the basidiospores and the morphology of the cystidia (Singer et al. 1983). The diagnostic characteristic of *T. versiformis* is the diverse morphology of the tip of the cheilocystidia.

Key to the *Tylopilus* known from Brazil

1. Pileus yellow orange with red tones; stipe and hymenophore whitish to cream……...…….……*T. balloui*
1´. Pileus pinkish to brownish; stipe cream pinkish to dark gray to black……..2
2. Pileus pink covered by finelly black fibrils; basidiospores and basidia dimorphic……*T. dimorphicus*
2´. Pileus brownish, glabrous to finelly tomentose; basidiospores and basidia monomorphic…….……3
3. Stipe dark gray to black covered by a whitish pruina……*T. nigrostipitatus*
3´. Stipe cream to pinkish, glabrous to reticulate…….…..……4
4. Stipe reticulate…….……..5
4´. Stipe glabrous to velvet…….……....6
5. Pleurocystidia diverticulate to versiform; cheilocystidia subclavate to cylindrical with variable endings, like spiral, hook, bifurcate and sinuous; growing in Altantic forest *restinga*……...……..*T. versiformis*
5´. Cystidia fusoid to ampullaceous with narrow subobtuse to subacute neck; growing in the Amazon *campinarana*……..…*T. arenarius*
6. Basidiomes short up to 35 mm tall; basidiospores 7−9 x 4−5 µm……..*T. pygmaeus*
6´. Basidomes up to 75 mm tall; basidiospores 8-12 x 5-8 µm……...*T. potamogeton*

Additional notes

Tylopilus potamogeton var. *potamogeton* and var. *aquarius* differ mainly by the place where they grow and by characteristics of the tomentum of the pileus. *Tylopilus potamogeton* var. *aquarius* grows mainly on lower portions of the Amazon igapó forest where the areas remain covered by water for long periods of the year and the tomentum is thicker and of pileus and stipe more livid. *Tylopilus potamogeton* var. *potamogeton* grows in dryer areas and the tomentum is thinner and the colors in part paler (Singer et al 1983).

Tylopilus acutesquamulosus was not included in this work because the excicate was not found at INPA herbarium. *Tylopilus aculeatus* is an unpublished name which specimen was deposited at INPA by Singer (INPA 82381/ R.Singer B11484).

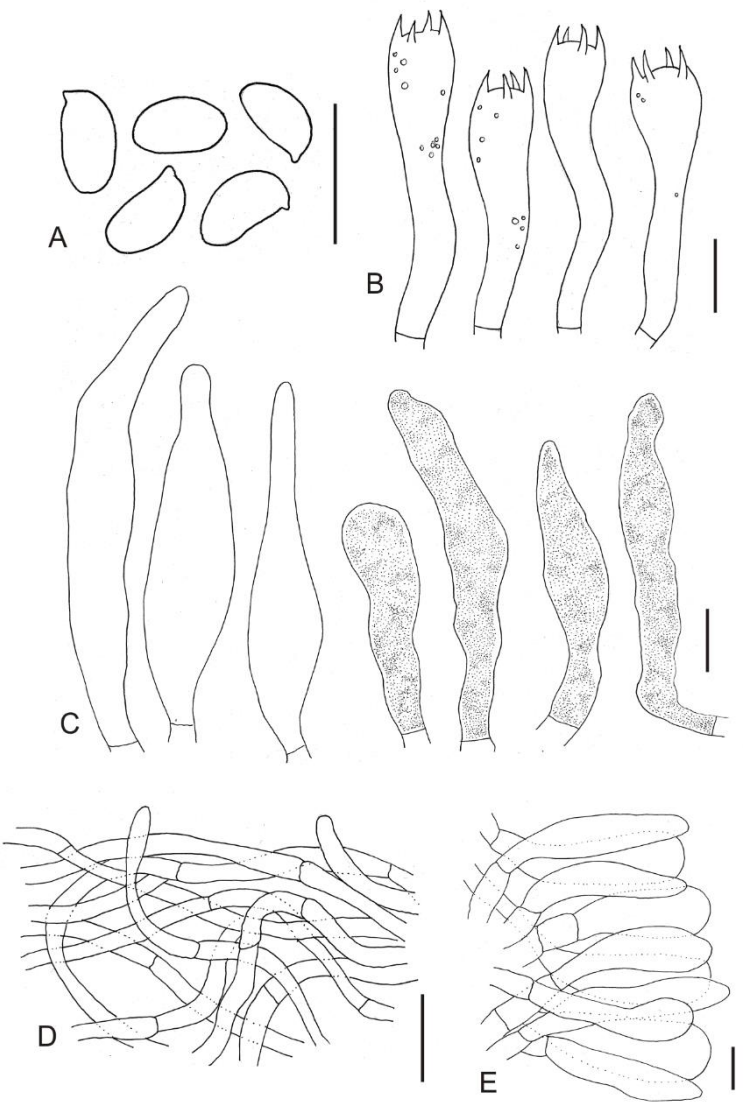

FIGURE 1: Microcharacters of *T. balloui* (Peck) Sing. **A**-Basidiospores; **B**-Basidia; **C**-Cystidia; **D**-Suprapileipellis; **E**-Stipitipellis (MAN 216). Bar (A, B, C, E) = 10 µm (D) = 25 µm.

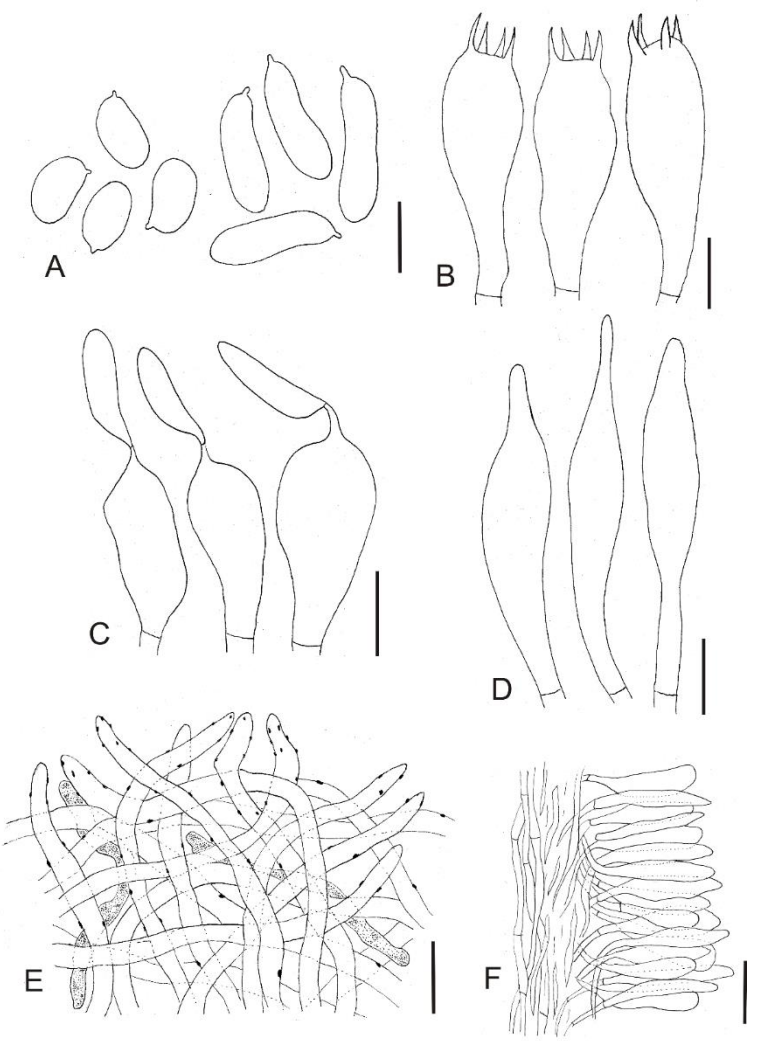

FIGURE 2: Microcharacters of *T. dimorphicus* Magnago & M.A. Neves. **A-**Basidiospores; **B-**Basidia; **C-** Basidia with 1 sterigma and basidiospore; **D-C**ystidia; **E-**Pileipellis; **F-**Stipitipellis (TYPE DLK 382). Bar (A, B, C, D, E, F) = 10 µm.

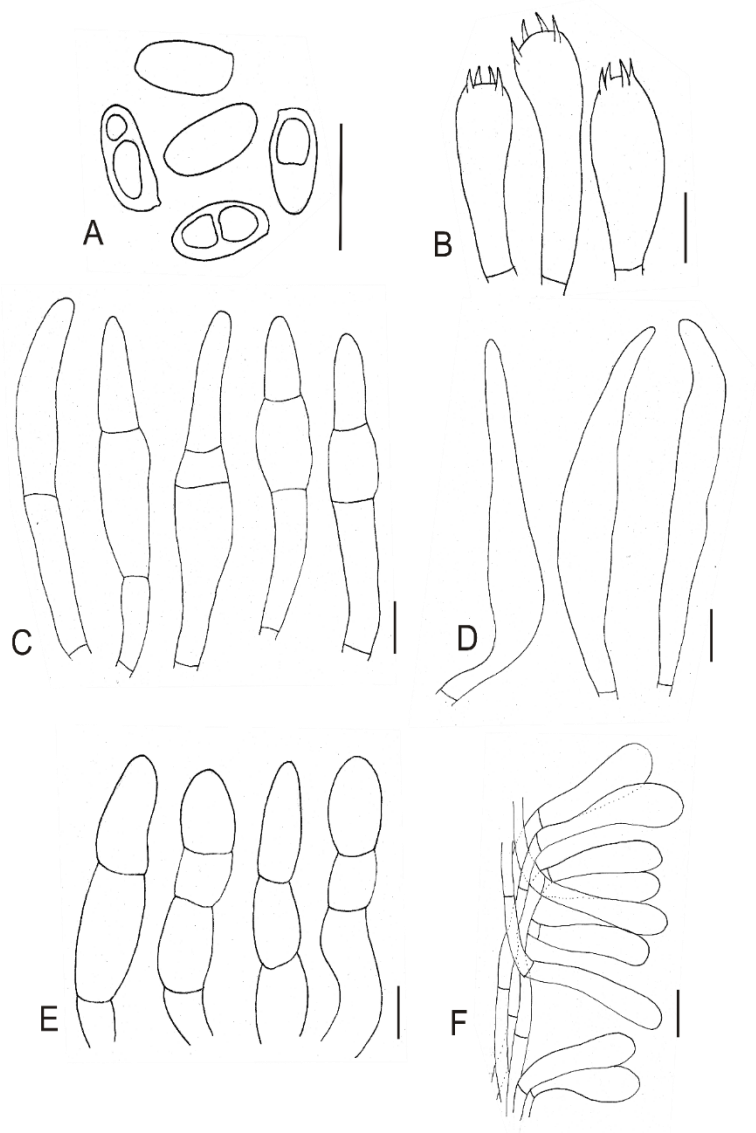

FIGURE 3: Microcharacters of *T. nigrostipitatus* Magnago & M.A. Neves. **A**-Basidiospores; **B**-Basidia; **C**-Cheylocystidia; **D**-Pleurocystidia; **E**-Pileipellis; **F**-Stipitipellis (TYPE MAN 389). Bar (A, B, C, D, E, F) = 10 μm.

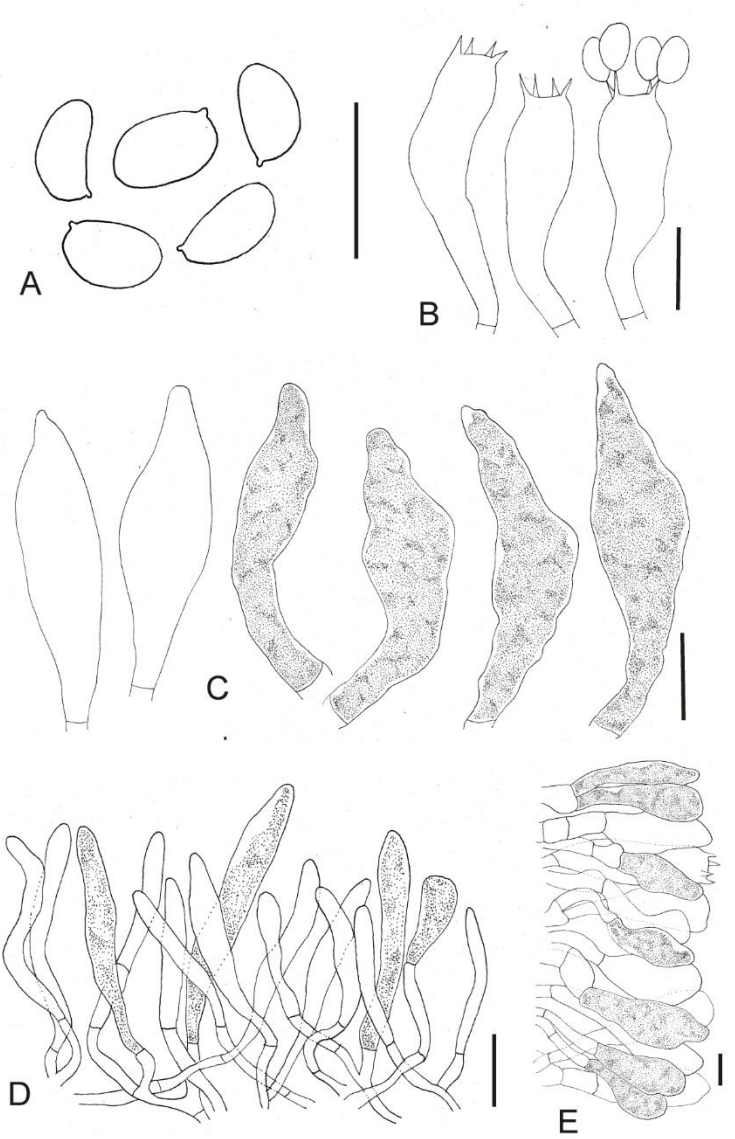

FIGURE 4: Microcharacters of *T. pygmaeus* Magnago & M.A. Neves. **A**-Basidiospores; **B**-Basidia; **C**-Cystidia; **D**-Suprapileipellis; **E**-Stipitipellis (TYPE, ACM 486). Bar (A, B, C, E) = 10 µm (D) = 25 µm

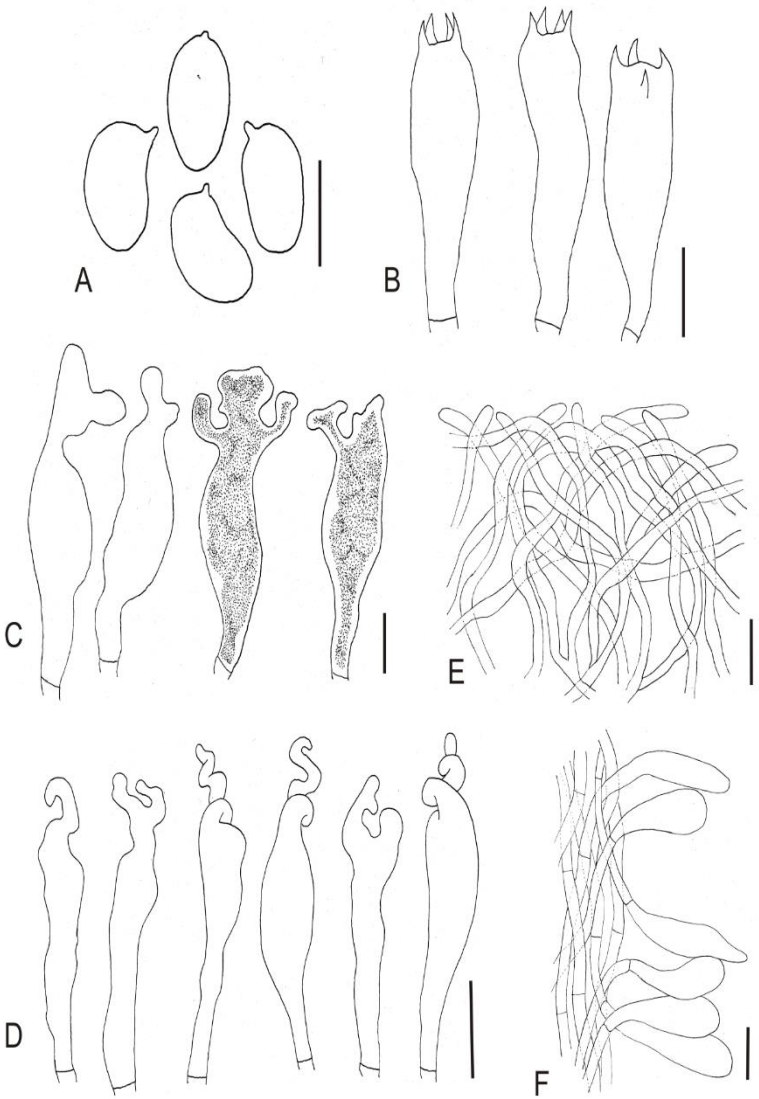

FIGURE 5: Microcharacters of *T. versiformis* Magnago & M.A. Neves. **A**-Basidiospores; **B**-Basidia; **C**-Pleurocystidia; **D**-Cheilocystidia; **E**-Suprapileipellis; **F**-Stipitipellis (TYPE, ACM 296). Bar (A, B, C, D) = 10 μm (E, F) = 25 μm

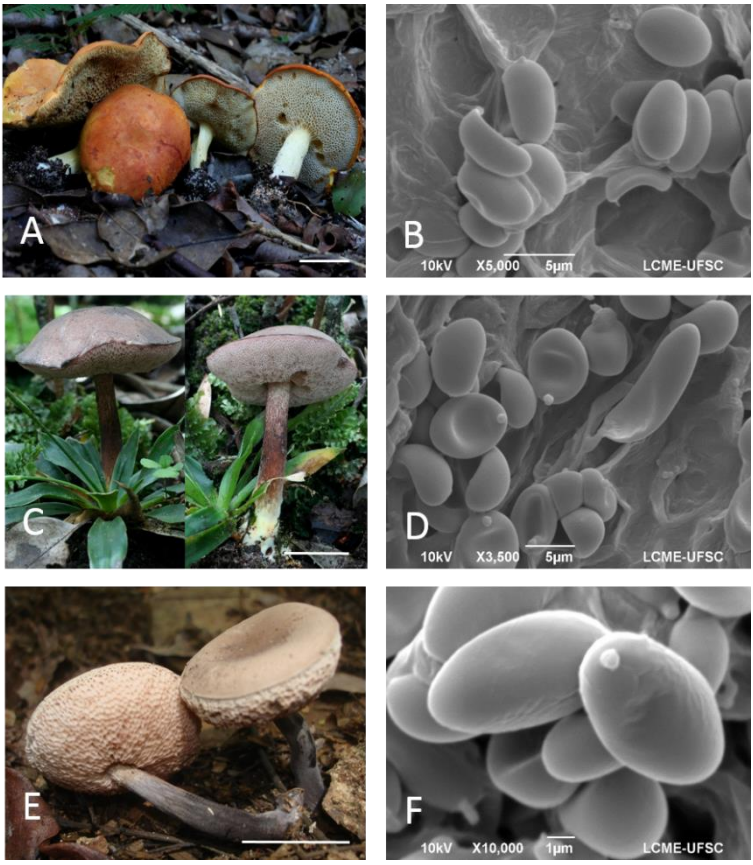

FIGURE 6: Basidiomes in the field and Scanning Electron Microscopy (SEM) of the basidiospores. **A,B-** *Tylopilus balloui* (Peck) Sing; **C,D-** *Tylopilus dimorphicus* Magnago & M.A. Neves; **E,F-** *Tylopilus nigrostipitatus* Magnago & M.A. Neves. (Bar A,C,E = 2.5 cm)

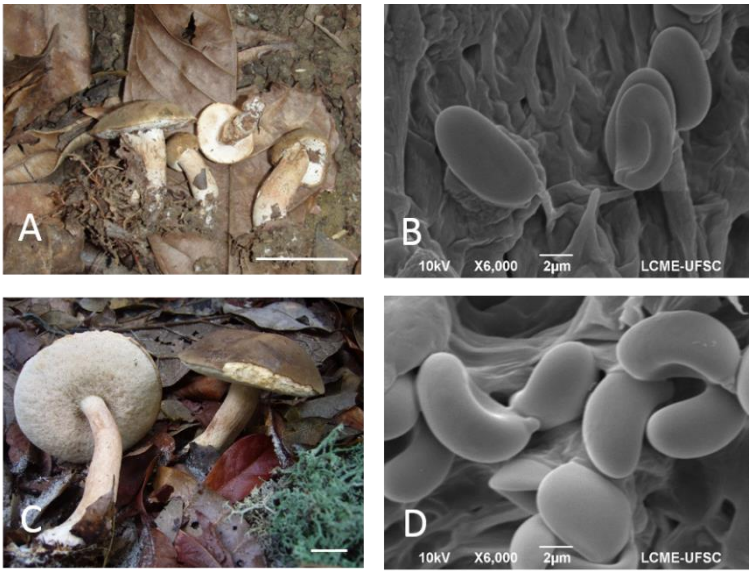

FIGURE 7: Basidiomes in the field and Scanning Electron Microscopy (SEM) of the basidiospores. **A,B-** *Tylopilus pygmaeus* Magnago & M.A. Neves; **C,D-** *Tylopilus versiformes* Magnago & M.A. Neves. (Bar A,C= 2.5 cm)

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4.2 **CAPÍTULO II:** Artigo

New species of *Fistulinella* (Boletaceae) from Atlantic Forest, and first record of *Fistulinella cinereoaba* for Brazil

Altielys Casale Magnago[1]* & Maria Alice Neves[1]

*Artigo a ser submetido para publicação na revista *Nova Hedwigia.*

Title: **New species of *Fistulinella* (Boletaceae) from Atlantic Forest, and first record of *Fistulinella cinereoaba* from Brazil**

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Abstract: Three species of *Fistulinella* are described as new for science. *Fistulinella cinereoalba* is registered for the first time from Brazil. The specimens were collected in the Brazilian Atlantic Forest. Fully macro and microscopic descriptions, photographs of the basidiomes, microscopic illustrations and Scanning Electron Microscopy of the basidiospores are presented for each species.

Key words: Agaricomycetes, Boletales, Neotropics, systematic.

Introduction

The Atlantic Forest is considered one of the most important worldly hotspot (Myers et al. 2000; Martini et al. 2007; SOS Mata Atlântica 2013), a biome with high diversity of organisms, including many endemics species, with large environmental variation distributed along Brazilian Atlantic coast and few inland areas. Originally, it covered an area of 1.300.000 km^2 (~ 15% of the country). Currently, after decades of deforestation for wood extractives and agroindustry, less than 8% of this area preserves the original biotic characteristics (Dean 1932-1994; SOS Mata Atlântica 2013). Although boletoid species are mainly known from several temperate environments, but a great diversity has been observed in our studies in tropical Brazilian forests.

Fistulinella Henn. encompasses ~ 27 species, with distribution mainly tropical (Pegler and Young 1981; Singer 1978, 1986; Singer et al. 1983, 1991; Watling and Gregory 1989; Ortiz-Santana et al 2007; Watling 2008, Kirk et al. 2008, Fulgenzi et al. 2010). For this paper we followed the circunscription of *Fistulinella* as defined by Singer (1986): a bolete species with smooth elongate-fusoid basidiospores, some or all weakly to distinctly dextrinoid; hyaline cystidia, without dextrinoid internal bodies; gelatinized lateral stratum in the hymenophoral trama; hyphae without clamp connections; trichodermium, ixotrichodermium or ixocutis pileipellis; white hymenophore that is pinkish when mature; pink to pink-brown spore print.

There are only two records of *Fistulinella* from Brazil: *F. campinaranae* Singer from Amazonas (Singer et al. 1983) and *F. violaceipora* (G. Stev.) Pegler & T.W.K. Young from Paraíba (Oliveira & Souza 2002). In this study three new species of *Fistulinella* are described, one for Espírito Santo (*F. rhytidocystidiata*), and two for Bahia (*F. alboaurantiaca* and *F. conduruensis*). *Fistulinella cinereoalba* Fulgenzi & T.W. Henkel is registered for the first time from Brazil.

Material and methods

Field expeditions were carried out in Espírito Santo (Southeastern Brazil) on municipality of Santa Teresa at Reserva Biológica Augusto Ruschi (19°54'19.60"S, 40°34'8.20"W), and in Bahia (Northeastern Brazil) on municipality of Itacaré at Parque Estadual da Serra do Conduru and Fazenda Marambaia (14°20'1''S, 39°5'1''W). The vegetation type in these areas is Atlantic Forest and the climate is tropical humid with high annual rainfall (2800 mm), and the mean annual temperature varies between 20ºC and 31ºC. These areas are considered *hot-points* within the *hot-spots* of the Brazilian biodiversity, with a high level of endemism (Martini et al. 2007).

Macro and microscopic analysis of the specimens followed traditional methods used for mushrooms (Largent 1986; Largent et al. 1977). The

basidiomes were slowly dehydrated at a low temperature (about 40ºC) on an electric dryer (Total Chef TCFD-05 Deluxe). Color codes (e.g. OAC 663) for macroscopic descriptions were based on the Online Auction Color Chart (Kramer 2004). Q_m refer to the Quocient average length/width ratio range from the basidiospores. For scanning electron microscopy (SEM) of the basidiospores, fragments of the hymenophore were removed from dried basidiomes, mounted directly on aluminum stubs using carbon adhesive tabs, and coated with 30 nm of gold, and examined with a scanning electron microscope operating at 10KeV at Laboratório Central de Microscopia Eletrônica da Univercidade Federal de Santa Catarina (LCME-UFSC). Voucher specimens were deposited at Herbarium FLOR at the Universidade Federal de Santa Catarina (Thiers, continuously updated).

Taxonomy

Fistulinella alboaurantiaca Magnago & M.A. Neves **sp. nov.** *ad. int.*
Figs 1, 5AB

DIAGNOSIS: Pileus parabolic to broadly convex, yellow orange covered by a gelatinous pellicle when young, becoming matted-fibrillose; stipe white overlain by a gelatinous pellicle throughout; basidiospores 13−17 x 4−5 µm, subfusiform to fusiform; pleurocystidia fusiform and cylindrical septate; cheilocystidia cylindrical septate; pileipellis ixotrichodermal interrupted by repent hyphae.

ETIMOLOGY: Latin, *albo* = white, *aurantiaca* = orange; referring to the white stipe and orange pileus surface.

HOLOTYPUS: Brazil. Bahia: Itacaré, Ramal de acesso à Fazenda Marambaia. 14°20'1''S, 39°5'1''W, elevation 100 m; 26 Aug 2006. *Neves, M.A. 185* (HUEFS).

PILEUS 15–33 mm broad, parabolic to broadly convex, yellow orange (OAC 763), covered by a gelatinous pellicle, more visible in young basidiomes, when mature the surface become matted-fibrillose over a whitish ground, with orange brown (OAC 786) fibrils; margin entire. TUBES 20–50 mm long, depressed around stipe, pink-gray (OAC 676) with age; pores white in young basidiomes becoming pinkish gray (OAC 676) in age, 1–2 per mm, isodiametric. STIPE 45–73 x 30–48 mm, centrally, subequal, surface fibrillose overlain by a gelatinous pellicle throughout, entire white. White basal mycelium present. BASIDIOSPORES 13−17 x 4−5 µm (Q_m=3.03), subfusiform to fusiform, with suprahilar depression, light yellow, slightly dextrinoid, guttulate, smooth, thick walled. BASIDIA 27−35 x 10−12 µm, broadly clavate, thin walled, hyaline, inamyloid; 4-sterigmate, 3−4 µm long. PLEUROCYSTIDIA of two shapes: fusiform, 45−63 x 6−8 µm, hyaline,

inamyloid, smooth, wall slightly thick, frequent; cylindrical, 52−83 x 7−9 µm, with one or two transverse septa occurring in upper two-third, hyaline, inamyloid, smooth, thin walled. CHEILOCYSTIDIA 45−130 µm long, cylindrical, 4−5 µm wide, septate, slightly interwoven in lower portion, frequent in young basidiomes. HYMENOPHORAL TRAMA boletoid, mediostratum hyphae 4−9 µm, sub parallel, light yellow, inamyloid, smooth and thin walled; lateral stratum divergent, hyphae lighter imbedded in a gelatinized matrix. SUPRAPILEIPELLIS ixotrichodermal interrupted by repent hyphae resulted by the crackled pattern of the pileus surface, light brown, inamyloid, hyphae 5−7 µm wide. MEDIOPILEIPELLIS with hyphae suberect to erect, 3−4 µm wide, light yellow in a gelatinized matrix, 200−240 µm wide. SUBPILEIPELLIS repent, 40−60 µm wide, hyphae 4−5 µm wide, subparallel to interwoven. *Pileus trama* with interwoven hyphae, 4−12 µm wide, light yellow. STIPITIPELLIS with two layers, the top layer with concentrated tufts of slightly interwoven cylindrical elements, septate, 5−8 µm wide, projecting 150−260 µm, light yellow; the lower layer 150−170 µm wide with interwoven to sub parallel hyphae, hyphae 2−4 µm wide, immersed in a dense gelatinized matrix. STIPE TRAMA parallel to subparallel, hyphae 5−7 µm wide, light yellow in H_2O and KOH 3%, inamyloid. CLAMP CONNECTION: absent. SPORE PRINT: pinkish.

ADDITIONAL SPECIMENS EXAMINED: Brazil. Manaus: *Fistulinella campinaranae* var. *scrobiculata*, Estrada Manaus, Caracaraí, km 45, 12 January 1979, *Singer 11491;* 25 April 1980, *Singer 12131* (INPA). Guyana. Region 8 Potaro-Siparuni: *Fistulinella cinereoalba*, Pakaraima Mountains, Upper Potaro River Basin, vicinity of Potaro base camp, 17 June 2002, Henkel 8471 (ISOTYPE, NY).

The diagnostic features of this species include the yellow glutinous orange pileus surface on young basidiomes that turns matted-fibrillose on mature basidiomes; entire white stipe; fusoid, smooth slightly dextrinoid basidiospores that are up to 17 µm long; and pleurocystidia fusiform and septate broadly cylindrical. In the infrageneric classification of Singer (1986), *F. alboaurantiaca* fits in section *Fistulinella* Singer due to the viscid to glutinous pileus and stipe.

Fistulinella alboaurantiaca resembles *Fistulinella cinereoalba* Fulgenzi and T.W. Henkel from Guyana by the virtue of viscid basidiome, matted-fibrillose pileus in mature basidiome, white stipe, and basidiospores that are similar in size and shape. However *F. cinereoalba* has a gray pileus and basidiospores strongly dextrinoid, pleurocystidia that are cylindrical to aciculate and non septate, trichodermal pileipellis with evident dark yellow content weakly dextrinoid (Fulgenzi et al. 2010).

Fistulinella campinaranae Singer is also similar to *F. alboaurantiaca* due to the viscid to glutinous basidiomes with a grayish brown pileus, white stipe, and similar basidiospores, however *F. alboaurantiaca* has a matted-fibrillose pileus, cylindric pleurocystidia with one or two transverse septa, and pigmented pileipellis (Singer et al. 1983).

Fistulinella cinereoalba Fulgenzi and T.W. Henkel
Figs 2, 5CD

PILEUS 16–27 mm broad, convex, finely fibrillose, initially entire grayish brown (OAC 733) becoming matted-fibrillose over white ground with age, slightly viscid to almost dry; margin entire; context white. TUBES 3–6 mm long centrally, depressed around stipe, pinkish gray (OAC 753); pores gray whitish when young, maturing to pinkish (OAC 753), 2 per mm, isodiametric. STIPE 60–71 mm high to 2–3 mm broad at top and 3–4 mm broad at base, centrally, base fusiform, surface whitish fibrillose with some brownish erect turfs reminding dots, overlain by a gelatinous pellicle throughout, browning slightly with handling, context white. BASIDIOSPORES 14–18 x 4–6 µm (Q_m=3.23), subfusiform to fusiform, light yellow, weakly dextrinoid, muliguttulate, smooth, thick walled. BASIDIA 31–37 x 10–12 µm, narrowly clavate, thin walled, hyaline, inamyloid; 4-sterigmate, 4–5 µm long. PLEUROCYSTIDIA fusiform to aciculate, 43–76 x 10–17 µm, hyaline, inamyloid, smooth, thin walled. CHEILOCYSTIDIA of variable shapes: cylindrical, 24–42 x 3–4 µm, some cystidia with bifurcate apex; fusiform 46–52 x 7–8 µm; and cylindrical septate, 2–4 µm wide, more frequent in young basidiome. HYMENOPHORAL TRAMA boletoid, mediostratum of many narrow parallel hyhae, 2–4 µm broad, light yellow; lateral stratum lighter, hyphae 2–6 µm wide, divergent. PILEIPELLIS trichodermal, with ochre content in H_2O, dextrinoid, hyphae 5–7 µm wide, round apex, regulary septate. PILEUS TRAMA interwoven, hyphae 6–9 µm wide, light yellow. STIPITIPELLIS with two layers, up layer with clusters of slightly interwoven cylindrical elements, septate, hyphae 4–6 µm wide, with light yellow intracellular content in H_2O; down layer with very loosely thin hyphae, subparellel to interwoven, hyaline, immersed in a gelatinized matrix. STIPE TRAMA composed of vertically arranged hyphae, 6–10 µm broad. CLAMP CONNECTION: absent. SPORE PRINT: pinkish-brown.

HABIT, HABITAT AND DISTRIBUTION: Gregarious on soil under trees in Atlantic forest. In Brazil known only from Bahia (present study), but also registered from Costa Rica in forests dominated by *Dicymbe corymbosa* Spruce ex Benth. (Fulgenzi et al. 2010).

MATERIAL EXAMINED: Brazil, Bahia: Itacaré, Parque Estadual da Serra do Conduru, 30 Nov 2012, Col. DHC Rezende & CAS Montoya, *Magnago, A.C. 484* (FLOR).

ADDITIONAL SPECIMENS EXAMINED: Guyana. Region 8 Potaro-Siparuni: *Fistulinella cinereoalba*, Pakaraima Mountains, Upper Potaro River Basin, vicinity of Potaro base camp, 17 June 2002, Henkel 8471 (ISOTYPE, NY).

Fistulinella cinereoalba is recognized macroscopically by the small to medium stature of its basdiomes with a viscid gray pileus and white stipe, pink-gray hymenophore. Microscopically the diagnostic characteristics are the smooth subfusiform basidiospores, exhibiting a range of dextrinoid reactions; cylindrical to aciculate pleurocystidia, narrow cylindrical septate cheilocystidia, and a

gelatinous pellicle covering the stipitipellis and pileipellis (Fulgenzi et al 2010). This is the first record of *F. cinereoalba* from Brazil.

Fistulinella conduruensis Magnago & M.A. Neves **sp. nov**. *ad. int*
Figs 3, 5EF

DIAGNOSIS: Pileus ochraceous, planoconvex, slightly depressed in the center, velutinous, dry; stipe cream, base fusiform, glabrous, slightly glutinose; basidiospores 12−15 x 4−5 μm, fusiform; pleurocystidia lanceolate to ventricose, frequent, and broadly cylindrical septate, scattered; cheilocystidia narrowly cylindrical septate; pileipellis ixotrichodermal, golden brown.

ETIMOLOGY: referring to the site collection of Serra do Conduru, Bahia, Brazil.

HOLOTYPUS: Brazil. Bahia: Itacaré, Parque Estadual da Serra do Conduru. 30 Nov 2012, Col. DHC Rezende & CAS Montoya, *Magnago, A.C. 485* (FLOR).

PILEUS 17–23 mm broad, planoconvex, slightly depressed in the center, ochraceous (OAC 729) becoming lighter towards the margin, velutinous, dry; margin entire; context white, unchanging. TUBES 1.5–3 mm long, centrally, depressed around stipe, free, cream (OAC 816); pores 2–3 per mm, isodiametric. STIPE 40–65 mm high to 2–3 mm broad at top and 3–5 mm broad at base, subequal, fusiform base, glabrous, slightly glutinose, cream (OAC 857); context white, unchanging. BASIDIOSPORES 12−15 x 4−5 μm (Q_m=3.10), fusiform, light yellow to pinkish, inamyloid to slightly dextrinoid, guttulate, smooth. BASIDIA 26−34 x 10−11 μm, clavate, thin wall, hyaline, inamyloid; 2−4 sterigmate, 3−5 μm long. *Pleurocystidia* in two shapes: lanceolate to ventricose, 41−78 x 6−10 μm, hyaline, inamyloid, frequent; and broadly cylindrical, 48−70 x 7−12 μm, septate (2−3), hyaline, inamyloid, scattered. CHEILOCYSTIDIA narrowly cylindrical, more frequent in young basidiome, 58−85 x 4−6 μm, septate, apex rounded, breaks very easily in the septa, some of them branched. HYMENOPHORAL TRAMA boletoid, mediostratum parallel, hyphae 3−5 μm broad, light yellow, inamyloid; lateral stratum divergent, immersed in a gelatinized matrix; hyphae 4−5 μm broad. SUPRAPILEIPELLIS ixotrichodermal, golden brown, inamyloid, regularly septate, terminal cell 3−5 μm wide, apex rounded. MEDIOPILEIPELLIS interwoven to sub erect, hyphae 2−3 μm broad, light yellow, immersed in a gelatinized matrix. SUBPILEIPELLIS repent, hyphae 2−3 μm broad. PILEUS TRAMA interwoven, hyphae 6−10 μm wide, light yellow. STIPITIPELLIS with two layers, up layer with concentrated tufts of erect hyaline cylindrical elements, septate, 5−8 μm broad, light yellow, caulobasidia present; down layer with interwoven to subparallel hyaline hyphae, 2−4 μm wide, immersed in a gelatinized matrix. STIPE TRAMA parallel, hyphae 3−9 μm broad, hyaline. CLAMP CONNECTION: absent. SPORE PRINT: pinkish.

Fistulinella conduruensis is distinguished in the field by its ochraceous velutinous pileus surface; pinkish hymenophore with 2–3 pores per mm, the stipe is glabrous, slightly glutinous, and cream colored. The basidiospores are smooth, subfusiform, with slightly dextrinoid reaction, the pleurocystidia are very frequent and scattered, lanceolate to ventricose and septate.

Fistulinella conduruensis and *Fistulinella venezuelae* Singer & Digilo (1960, as *Tylopilus venezuelae*) have the same overall color on the pileus and a white stipe. However *F. venezuelae* have an obtuse slightly umbonate disc at the center of the pileus, longer basidiospores (up to 21.5 μm), elongate, fusoid to ampullaceous pleurocystidia.

Fistulinella rhytidocystidiata Magnago & M.A. Neves **sp. nov.** *ad. int.*
Figs 4, 5GH

DIAGNOSIS: Pileus chestnut brown becoming lighter with age, parabolic to convex, velutinous to depressed fibrillose, dry; stipe pinkish covered by a white pruina, browning with handling, slightly glutinose; basidiospores 14−22 x 4−5 μm, fusiform; pleurocystidia ventricose rostrate, winkled in the middle portion, very frequent, and broadly cylindrical septate, scattered; cheilocystidia hyphal, cylindrical, septate, frequent in young basidiome; pileipellis ixotrichodermal to ixotrichodermal palisade, honey brown.

ETIMOLOGY: Latin, *rhytido* = wrinkled, *cystidiata* = cystidia, referring to the pleurocystidia winkled in the middle portion.

HOLOTYPUS*:* Brazil. Espírito Santo: Santa Teresa, Reserva Biológica Augusto Ruschi, Casa da Pedra. 19°54'19.60"S, 40°34'8.20"W, 05 Dez 2012, *Magnago, A.C. 526* (HOLOTYPE FLOR).

PILEUS 10–40 mm broad, parabolic to convex, chestnut brown (OAC 657) becoming lighter with age (OAC 659), initially velutinous to depressed fibrillose when mature, dry; margin entire; context white, unchanging. TUBES 4–7 mm long centrally, strongly depressed around stipe almost free, whitish to cream (OAC 676); pores white when young, maturing to light pink (OAC 669), 1.5–2 per mm, isodiametric. STIPE 42–80 mm high to 5–7 mm broad at top and 10–15 mm at base, subclavate fusiform, slightly glutinose, pinkish (OAC 655) covered by a white pruina, browning with handling; context white, unchanging; extreme base with fine white rhizomorph. BASIDIOSPORES 14−22 x 4−5 μm (Q_m=3.44), fusiform, with suprahilar depression, light yellow, inamyloid, guttulate, smooth. BASIDIA 26−31 x 11−14 μm, broadly clavate, thin walled, hyaline, inamyloid; 4-sterigmate, 2−3 μm long. PLEUROCYSTIDIA in two shapes: ventricose rostrate 53−71 x 9−14 μm, hyaline, inamyloid, wrinkled in the middle portion, very frequent; and broadly cylindrical, septate (1−2) on the upper two third, 8−10 μm wide, projecting 26−54 μm above hymenium, hyaline, inamyloid, scattered. CHEILOCYSTIDIA hyphal, cylindrical, septate, frequent in young basidiome, 4−6

μm wide, projecting 86−75 μm. HYMENOPHORAL TRAMA boletoid, mediostratum parallel, hyphae 3−5 μm wide, light yellow, inamyloid; lateral stratum divergent, immersed in a gelatinized matrix; hyphae 4−7 μm wide. PILEIPELLIS in three layers immersed in a gelatinized matrix. SUPRAPILEIPELLIS ixotrichodermal to ixotrichodermal palisade, honey brown, inamyloid, regularly septate, terminal cell 4−11 μm wide, and apex rounded. MEDIOPILEIPELLIS interwoven to sub erect, hyphae 2−4 μm wide, pale yellow. SUBPILEIPELLIS repent, hyphae 2−3 μm wide. PILEUS TRAMA interwoven to subparallel, hyphae 3−11 μm wide, light yellow. STIPITIPELLIS with two layers, up layer with tufts of erect to suberect hyaline cylindrical elements, septate, 4−10 μm wide, light yellow, caulobasidia present; down layer with subparallel hyaline hyphae, 2−5 μm wide, immersed in a gelatinized matrix. STIPE TRAMA parallel, hyphae 3−11 μm wide, hyaline. CLAMP CONNECTION: absent. MACROCHEMICAL REACTIONS: NH_4OH on pileus surface becoming reddish orange, on stipe surface becoming yellow. SPORE PRINT: pinkish brown.

ADDITIONAL SPECIMENS EXAMINED: AUSTRALIA. QUEENSLAND: *Fistulinella mollis*, Landsborough. Dularcha National Park, track W of railroad line, 8 June 2007, *R.E. Halling 8985* (NY).

Fistulinella rhytidocystidiata is macroscopically recognized by the chestnut brown finely velutinous pileus, whitish to cream hymenophore and the pinkish stipe covered by a white pruina that turns brown when touched. Microscopically the basidiospores are fusiform to sigmoid (14−22 x 4−5 μm); the pleurocystidia are frequent, ventricose rostrate, wrinkled in the middle portion, but septate cylindrical pleurocystidia are also present.

Fistulinella mollis Watling that grows widely on eucalypt forests in Australia, is similar to *F. rhytidocystidiata* due to the presence of a brownish pileus and white to pink hymenophore. However the pileus in *F. mollis* is viscid to glutinous, and both the ventricose-rostrate pleurocystidia and the cylindric pleurocystidia are absent. *Fistulinella rhytidocystidiata* also has similarities to the Australian *Fistulinella prunicolor* (Cooke & Massee) Watling, however the latter has a darker brown and reddish pileus that is viscid when wet, the tubes are vinaceous pink, and the white stipe develops yellow stains with time (Watling & Li 1999).

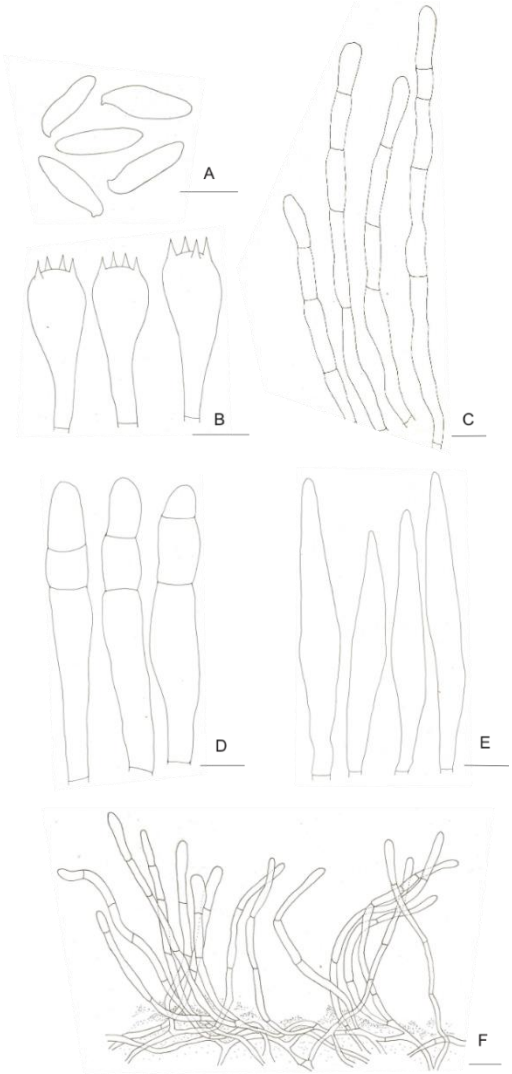

Fig 1: Microcharacters of *Fistulinella alboaurantiaca* (Holotype). **A**-Basidiospores; **B**-Basidia; **C**-Cheilocystidia; **D,E**-Pleurocystidia; **F**-Pileipellis. Bar (A, B, C, D, E, F) = 10 µm**.**

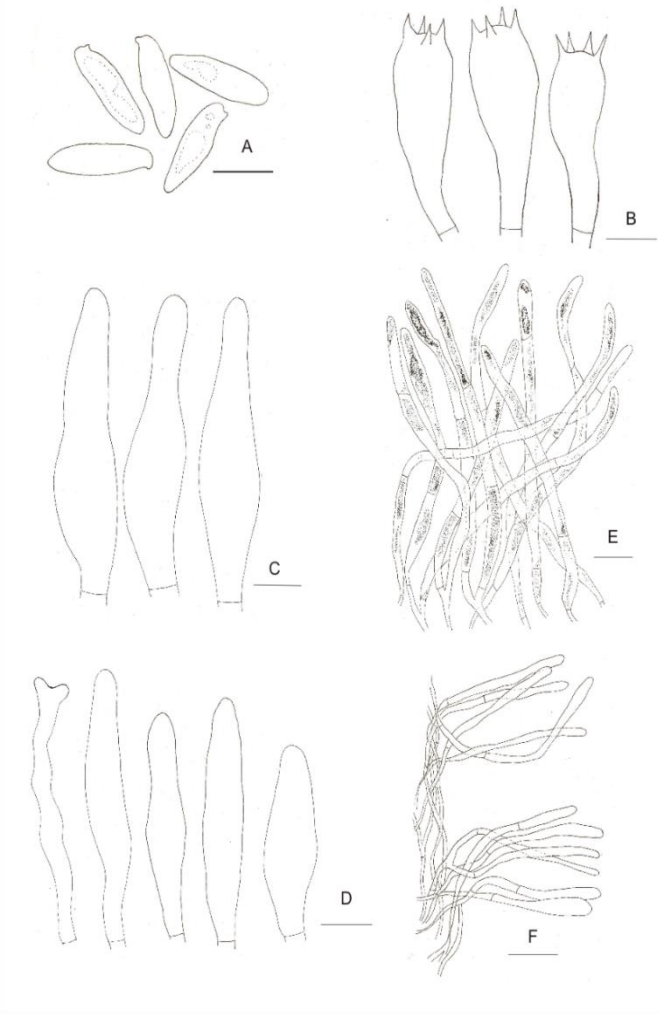

Fig 2: Microcharacters of *Fistulinella cinereoalba* (ACM 484). **A**-Basidiospores; **B**-Basidia; **C**-Pleurocystidia; **D**-Cheilocystidia; **E**-Pileipellis; **F**-Stipitipellis. Bar (A, B, C, D) = 10 µm (E,F) = 25 µm

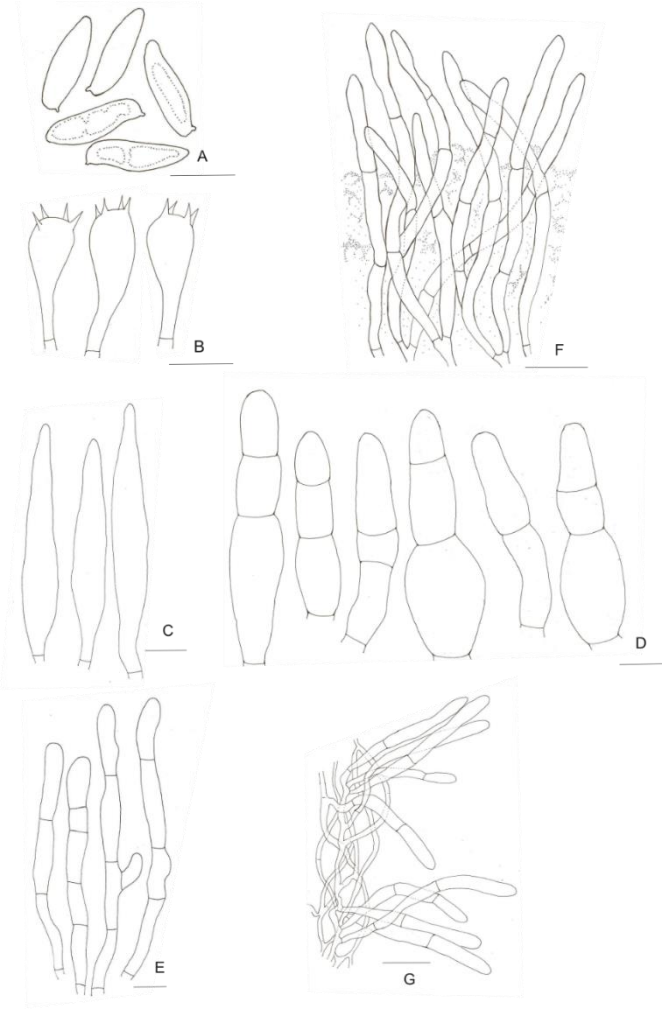

Fig 3: Microcharacters of *Fistulinella conduruensis* (Holotype). **A-** Basidiospores; **B-**Basidia; **C,D-**Pleurocystidia; **E-**Cheilocystidia; **F-** Suprapileipellis; **G-**Stipitipellis. Bar (A, B, C, D, E) = 10 µm (F,G) = 25 µm

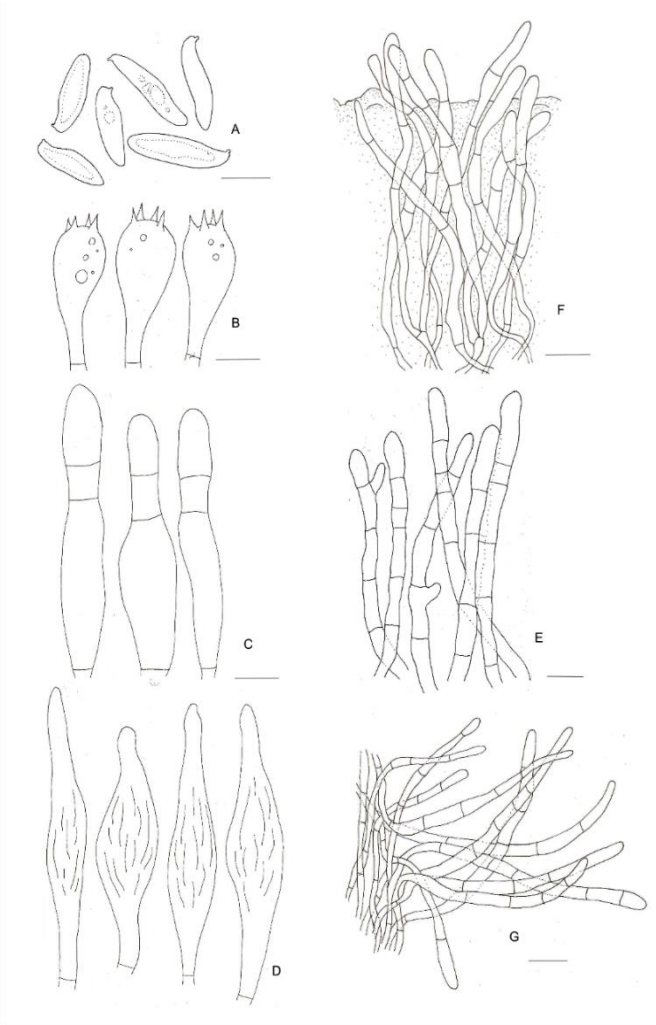

Fig 4: Microcharacters of *Fistulinella rhytidocystidiata* (Holotype). **A**-Basidiospores; **B**-Basidia; **C,D**-Pleurocystidia; **E**-Cheilocystidia, **F**-Suprapileipellis; **G**-Stipitipellis. Bar (A, B, C, D, E) = 10 μm (F,G) = 25 μm

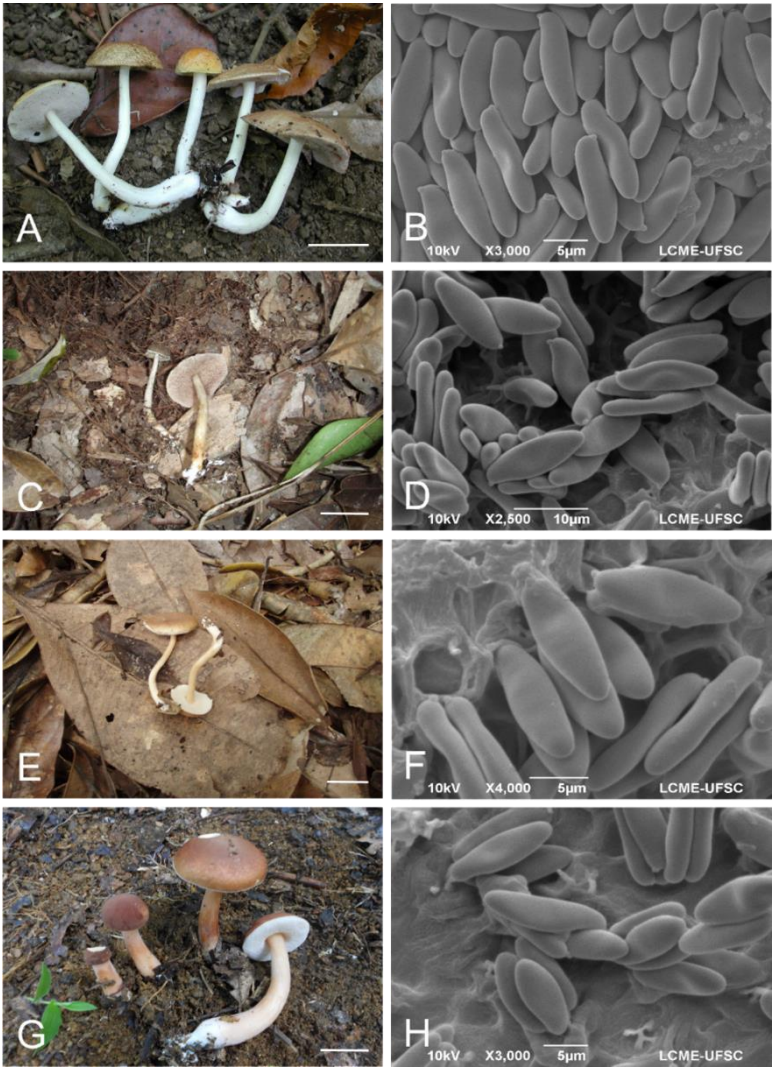

Fig 5: Photographs of the basidiomes in the field, and Scanning Electron Microscopy of the basidiospores. **A,B-** *F. alboaurantiaca* (Holotype); **C,D-** *F. cinereoalba* (ACM 484); **E,F-** *F. conduruensis* (Holotype)*;* **G,H-** *F. rhytidocystidiata* (Holotype). (Bar A, C, E, G = 2.5 cm).

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4.3 CAPÍTULO III: Nota científica

New record of Austroboletus festivus (Boletaceae) from Santa Catarina, Brazil

Altielys Casale Magnago & Maria Alice Neves

*Nota científica publicada online na revista Brazilian Journal of Botany (DOI: 10.1007/s40415-014-0048-3)

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SHORT COMMUNICATION

New record of *Austroboletus festivus* (Boletaceae) from Santa Catarina, Brazil

Altielys Casale Magnago · Maria Alice Neves

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Abstract The Atlantic forest is a biodiversity hotspot and harbors a great variety of fungi, many still undiscovered. Basidiomes were collected in coastal *restinga* on remnants of Atlantic forest in Florianópolis Island, Santa Catarina. This is the first record of *Austroboletus festivus* for the state and expands its geographic distribution, previously known in Brazil only for Pernambuco and Paraná. Color images of the basidomes, microscopic illustrations and scanning electron microscopy of the basidiospores are presented.

Keywords Agaricomycetes · Atlantic forest · Boletales · Systematic

Introduction

Austroboletus was proposed by Wolfe (1979) to accommodate species with tubulate hymenophore, dry or viscid pileus mostly covered by a trichodermium or ixotrichodermium pileipellis, a vinaceous brown to army brown spore print, elongated-fusoid ornamented spores, and cystidia generally without pigments or pseudoamyloid internal bodies (Singer 1986). Thirty species are known for the genus (Kirk et al. 2008), with ca. ten species in the neotropics (Singer 1986; Singer et al. 1983, 1991; Halling et al. 2006; Fulgenzi et al. 2010). *Austroboletus* is somehow similar to *Tylopilus* P. Karst. and *Fistulinella* Henn., differing mainly by the ornamented spores in *Austroboletus*, while the other two genera have smooth spores (Singer 1986).

Records of *Austroboletus* from Brazil are very scarce. Four species have been reported for the country, three from Amazonas [*Austroboletus graciliaffinis* Singer, *Austroboletus olivaceus* Singer and *Austroboletus rionegrensis* (Singer & I.J.A. Aguiar) Singer] and one from Pernambuco and Paraná [*Austroboletus festivus* (Singer) Wolfe 1980] (Singer 1970; Watling and Meijer 1997). With the aim to improve the knowledge of boletoid fungi in the Atlantic forest, we present a new record of *A. festivus* from Brazil.

Materials and methods

Collections were conducted in March 2013 during the rainy season on the *restinga* at Parque Municipal das Dunas da Lagoa da Conceição, Florianópolis, Santa Catarina, Southern Brazil (27°36′46.22″S, 48°27′10.45″W). Macro and microscopic analysis of the material followed traditional methods used for basidiomycetes (Largent 1986; Largent et al. 1977). For scanning electron microscopy (SEM) of the basidiospores, fragments of the hymenophore were removed from dried basidiomes, mounted directly on aluminum stubs using carbon adhesive tabs, and coated with 30 nm of gold, and examined with a SEM operating at 10 keV. Color codes (e.g., OAC 663) are based on the Online Auction Color Chart (Kramer 2004). Voucher material was deposited at Herbarium FLOR from the Universidade Federal de Santa Catarina (Thiers, continuously updated).

Results and discussion

Austroboletus festivus (Singer) Wolfe, Biblthca Mycol. 69: 92 (1980) [1979] (Figs. 1, 2) =*Porphyrellus festivus* Singer, Publções Inst. Micol. Recife 304: 18 (1961).

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4.4 CAPÍTULO IV - Notas taxonômicas em *Boletellus, Chalciporus* e *Fistulinella.*

Este capítulo inclui espécies já registradas para o Brasil que foram recoletadas e foram redescritas incluindo fotos dos materiais frescos e de MEV dos esporos. *Boletellus ananas* (M.A. Curtis) Murrill foi recoletada em região inundável da Amazônia, onde já havia sido registrada por Singer et al. (1983). *Boletellus* cf. *lepidospora* E.-J. Gilbert ex Heinem. foi recoletada no estado da Paraíba,no entanto no município de Mamanguape. E *Chalciporus trinitensis* var. *amazonicus* L. D. Goméz foi registrada pela primeira vez para o Espírito Santo, já havendo registro desta espécie para o Amazonas. Está aqui incluída também a descrição de uma nova espécie de *Fistulinella* para a ciência, ainda sem nome (*Fistulinella* sp1), que não foi incluída no artigo porque o material coletado não era suficiente e não estava em boas condições para ser designado como tipo de uma nova espécie. Espera-se recoletar o material em boas condições e então publicar o novo táxon futuramente.

Boletellus ananas (M.A. Curtis) Murrill, Mycologia 1(1): 10 (1909).
Fig. 1, 5ABC

=*Boletus ananas* M.A. Curtis 1848

Pileus 56 mm broad, convex, surface moist and scaly; fascicles of fibers forming large depressed squarrose scales, red brown (OAC 656) to light red (OAC 615), fading to tan or pale buff; margin slightly uplifted, apendicullate from partial veil; context white to yellowish, readily staining blue when cut. *Tubes* 7−9 mm long centrally, yellow (OAC 803), often tinged red brown, adnexa; pores 1 mm broad, angular to elongate next to the stipe, yellow, staining blue when injured. *Stipe* 82 x 6 mm, subequal, surface smooth to fibrillose, whitish to pallid throughout, reddish in the apex; context whitish to cream (OAC 815), turning red and blue when exposed. *Basidiospores* 16−21 x 6−8 µm (Q=2.80), cylindrical to subfusoid, longitudinally winged, cross-striated, faint yellow, inamyloid, guttulate, thick walled, hilar appendage 0.5−1 µm long. *Basidia* 39−48 x 10−12 µm, clavate, hyaline, inamyloid, guttulate; 4-sterigmate, 2−4 µm long. *Pleurocystidia* of two types: 36−60 x 9−12 µm, clavate to cylindrical, frequent and 69−100 x 12−16 µm, ventricose-rostrate; both types hyaline and inamyloid. *Cheilocystidia* similar to pleurocystidia in size and shapes. *Hymenophoral trama* subparallel to parallel, hyphae 7−14 µm wide, faint yellow. *Pileipellis* repent to subtrichodermal in a gelatinized matrix, golden brown, inamyloid, terminal hyphae 5−12 µm wide. *Pileus context* interwoven, hyphae 4−15 µm wide, thin walled, grayish blue in H_2O, inamyloid. *Stipitipellis* repent, with scattered projecting tufts of hyphae, terminal elements 6−8 µm wide. *Stipe trama* densely packed of parallel hyphae, yellowish, and hyphae 3−6 µm wide, regularly septate. *Clamp connections* absent. *Macrochemical reactions:* Imler's reaction positive

in the pileus and stipe trama. The same fleeting blue reaction was also observed in water and Congo Red. *Spore print* olivaceous.

Habit, habitat and distribution: Solitary on soil under trees, at *campinarana* area in Amazon Forest. Registrated for Amazonas (Singer et al. 1983).

Specimens examined: **BRAZIL. AMAZONAS**: Manaus, Ramal Novo do Amanhecer, Canal do Tarumãzinho. 2°50'50"S, 60°14'08" W, 27 April 2012, *Komura, D.L. 380* (INPA).

Additional specimens examined: BRAZIL. AMAZONAS: *Boletellus ananas* var. *minor* Singer, Estrada Manaus-Caracaraí, km 125, 04 April 1978, R. Singer, B 10913 (INPA); *Boletellus fallax*, Estrada Manaus-Caracaraí, km 45, 03 Aug 1978, R. Singer & I. Araújo, B 11346 (INPA).

Comentary: *Boletellus ananas* is distinguished by the presence of a partial veil, that in mature basidiome hangs on the cap margin; the smooth, whitish stem with a reddish zone near the apex; and the yellow pore surface that bruises blue and eventually discolors reddish brown. The specimen collected was somewhat old and moist, losing some of the diagnostic characteristics of the pileus surface, but together with the others macro and microscopic features the specimen agreed with the description of *Boletellus ananas* var. *ananas* (Singer et al. 1983).

Boletellus* cf. *lepidospora E.-J. Gilbert ex Heinem., Bull. Jard. Bot. Nat. Belg. 21: 293 (1951)
Fig. 2, 5D

Basidiospores 8−10 x 6−7 µm (Q=1.40), ellipsoid, longitudinally winged, pale yellow, inamyloid, thick walled. *Basidia* 27−42 x 12−14 µm, clavate, thin walled, hyaline, inamyloid; 4-sterigmate, 2−3 µm long. *Cystidia* on edges and sides not differentiated from each, 36−56 x 7−12 µm, fusiform to ventricose, hyaline, inamyloid. *Hymenophoral trama* parallel to subparallel, hyphae 4−12 µm wide, hyaline, inamyloid, smooth and thin walled. *Pileipellis* trichodermal with disarticulated terminal hyphae, acute to papilate, brownish, inamyloid, hyphae 8−15 µm wide; oileferous hyphae present. *Pileus context* interwoven, hyphae 6−16 µm wide, light yellow. *Stipitipellis* repent, with projecting tufts of caulobasidia and caulocistidia, clavate to fusiform, 13−15 µm wide. *Stipe context* parallel to subparallel, hyphae 5−12 µm wide, light yellow, inamyloid. *Clamp connections* absent. *Macrochemical reactions:* not observed. *Spore print* not observed.

Habit, habitat and distribution: Solitary on white sand soil under trees, at *tabuleiro* area in Atlantic Forest. Registrated for Paraíba (Oliveira 1987).

Specimens examined: **BRAZIL. PARAÍBA:** Mamanguape, Reserva Biológica Guaribas, SEMA II. 6°44'14"S, 35°8'55"W, 15 Aug 2009, *Neves, M.A. 481* (FLOR); Mata da Grota, 23 Sep 2009, *Neves, M.A. 502* (FLOR).

Additional specimens examined: BRAZIL. PARAÍBA: *Boletellus pustulatus* (Beeli) E.-J. Gilbert, Universidade Federal da Paraíba, 02 Jul 1990,

I.C. Oliveira & M.F.M. Guimarães 297 (JPB); 12 Mar 1985, M.A. de Souza, J.V.B. Silva, VL.F. Araújo & I.C. Oliveira 14 (JPB).

Commentary: Unfortunately the specimen was not described or photographed when fresh. The lack of a good macroscopic description makes it difficult to assert the identification of the specimen to the species level. However, the typical elongate-fusoid spores with longitudinal ribs or striations is a typical character to place the specimen in *Boletellus.* According to some macrocaracters provided by the collector like the velvet yellow brown pileus, yellow hymenophore, and microscopically ridged short spores with no cross-striae, the ventricose to fusiform cystidia, and the terminal acute to papilate hyphae of the pileipellis, this collections fits the description of *Boletellus lepidospora* (Heinneman & Goossens-Fontana 1954).

Chalciporus trinitensis* var. *amazonicus L. D. Goméz Revta Biol. Trop. 44(Suppl. 4): 80 (1997)
Fig. 3, 5EF

Pileus 15−45 mm broad, convex to plano-convex, to plano-depressed when mature, surface dry becoming subviscid, velvet to finely fibrillose, yellow brown to cinnamon (OAC 683, OAC 650), with red tones; margin entire, enrolled sometimes; context 2−4 mm, unchanging. *Tubes* 3−5 mm long, pinkish (OAC 655) to yellow (OAC 805), adnate; pores 1−1.5 mm broad, irregular, angular to elongate near the margin, not staining under pressure. *Stipe* 21−58 mm × 3−5 mm, subequal, light brown (OAC 717) to orange red (OAC 642), smooth to finely fibrillose; context light yellow (OAC 815), unchanging. *Basidiospores* 11–13 x 4–5 µm (Q=2.54), subfusiform, with suprahilar depression, pale yellow, slightly dextrinoid in accumulation, smooth, thin walled. *Basidia* 25–32 x 8–10 µm, clavate, thin walled, hyaline, inamyloid; 4-sterigmate, 3–4 µm long. *Cystidia* on the edges and sides not differentiated from each other, 48–84 x 8–13 µm, ventricose-rostrate to lanceotate, few with 1-2 septa, hyaline, inamyloid, frequent. *Hymenophoral trama* divergent to subparalel in a gelatinized matrix, hyphae 7–10 µm wide, hyaline, inamyloid, thin walled. *Pileipellis* repent to subtrichodermal, reddish brown, inamyloid, terminal hyphae 5-8 µm wide. *Pileus context* interwoven to subparallel, hyphae 4–12 µm wide, light yellow. *Stipitipellis* repent, hyphae 4-6 µm wide, amber yellow, inamyloid. *Caulocystidia* 21–27 x 9–10 µm, clavate, forming scattered clusters. *Stipe context* parallel, hyphae 5-13 µm wide, light yellow, inamyloid. *Clamp connection* absent. *Macrochemical reactions*: NH_4OH and KOH3% on surfaces becoming yellow to unchanging. *Spore print* reddish brown.

Habit, habitat and distribution: Gregarious on soil in Atlantic Forest. First record from Espírito Santo (present study). In Brazil also known for Amazonas (Singer et al. 1983, Goméz 1996).

Specimens examined: **BRAZIL. ESPÍRITO SANTO:** Santa Teresa, Reserva Biológica Augusto Ruschi, Casa da Pedra. 19°54' 19.60"S, 40°34'

8.20"W, 04 Dez 2012, *Magnago, A.C. 492* (FLOR); 05 Dez 2012, *Magnago, A.C. 528, 529* (FLOR).

Additional specimens examined: BRAZIL. AMAZONAS: *Chalciporus trinitensis* var. *amazonicus*, Igarapé do Tarumãnzinho, 14 Dec 1978, R.Singer, B 11434 (INPA).

Commetary: These collections constitute the first record of *Chalciporus trinitensis* var. *amazonicus* for the Atlantic Forest and Espírito Santo state. The description here presented agrees with the description of *Chalciporus trinitensis* by Singer et al. (1983), but differs on the size of the cystidia that are longer (48 to 84 μm) than the ones described by Singer (25–54 μm), and by the presence of a few septate pleurocystidia that were not included in Singer's description.

The type of the species *Chaciporus trinitensis* was collected by Heinemann in Trinidad in 1953 and it is characterized by having incrusted cystidia and elongated filiform cheilocystidia (Singer et al. 1983). In Brazil *Chalciporus trinitensis* was collected in Amazonas by Singer in 1978. Later on, Goméz (1996) created the variety *amazonicus* for the specimen from Amazonas. The characteristics that Goméz considered to create the variety were the presence of shorter less incrusted cheilocystidia, basidiospores with suprahilar depression, and the depressed hymenophore around the stipe.

Fistulinella sp. 1

Fig. 4, 5GH

Pileus 55 mm broad, convex, cinnamon (OAC 680) in the center becoming lighter toward the margin, surface with depressed fibrils covered by a gelatinous pellicle throughout; margin entire; context white, unchanging. *Tubes* 5–8 mm long centrally, strongly depressed around stipe, almost free, pinkish gray (OAC 676); pores whitish, 1–1.5 per mm, isodiametric. *Stipe* 95 mm high, 7 mm broad at top and 15 mm broad at base, subclavate fusiform, surface glabrous, covered by a fibrillose pinkish gelatinous pellicle, easily removable; context white, unchanging. *Basidiospores* 14−16 x 4−5 μm (Q=3.19), subfusiform to fusiform, yellow pinkish, inamyloid to weakly dextrinoid, thin walled. *Basidia* 21−28 x 10−13 μm, clavate, thin walled, hyaline, inamyloid, 4-spores; sterigmate 3−5 μm long. *Pleurocystidia* 65−72 x 7−10 μm, fusiform, hyaline, inamyloid, scattered. *Cheilocystidia* 73−80 x 10−12 μm, ventricose-rostrate, hyaline, inamyloid, frequent. *Hymenophoral trama* divergent to subparalel, hyphae 4−11 μm broad, hyaline, inamyloid, smooth and thin walled. *Suprapileipellis* with disarticulate hyphae, light yellow, inamyloid, hyphae 4−6 μm wide, immersed by a gelatinous pellicle. *Mediopileipellis* interwoven to suberect hyphae, in a gelatinized matrix, hyphae 2−4 μm broad, light yellow. *Subpileipellis* repent, light yellow, hyphae 3−5 μm wide, subparallel to interwoven. *Pileus trama* interwoven, hyphae 3−14 μm broad, light yellow. *Stipitipellis* in two layers, uplayer repent, hyphae 2−4 μm broad, hyaline, inamyloid; downlayer subparallel, hyphae 1−3 μm broad, immersed in a gelatinized matrix. *Stipe trama* parallel, hyphae 3−5 μm wide, hyaline, inamyloid. *Clamp connection*: absent. *Macrochemical reactions*:

NH_4OH on pileus surface becoming orange; on stipe surface becoming light yellow. *Spore print*: pinkish brown.

Habit and habitat: Growing solitary on soil in Atlantic Forest.

Specimens examined: **BRAZIL. ESPÍRITO SANTO:** Santa Teresa, Reserva Biológica Augusto Ruschi, Casa da Pedra. 19°54'20.18"S, 40°34'7.02"W, 04 Dez 2012, *Magnago, A.C. 491* (FLOR).

Additional specimens examined: AUSTRALIA. QUEENSLAND: *Fistulinella mollis*, Landsborough. Dularcha National Park, track W of railroad line, 8 June 2007, *R.E. Halling 8985* (NY).

Commentary: Fistulinella sp.1 fits in section *Fistulinella* Singer due to the viscid to glutinous pileus and stipe. More collections are needed to make a better description because the specimen was old and some of the caracteristics may have been lost.

There are some similarities between *Fistulinella* sp. 1 and *Fistulinella mollis*, such as the viscid brownish pileus and the whitish stipe. However *F. mollis* grows in *Eucalyptus* forest in Australia, and *Fistulinella* sp.1 has scattered pleurocystidia fusiform and frequent pleurocystidia ventricose-rostrate; and the pilepellis composed by disarticulate hyphae immersed in a gelatinous matrix that are also different from the ones observed by *F. mollis*.

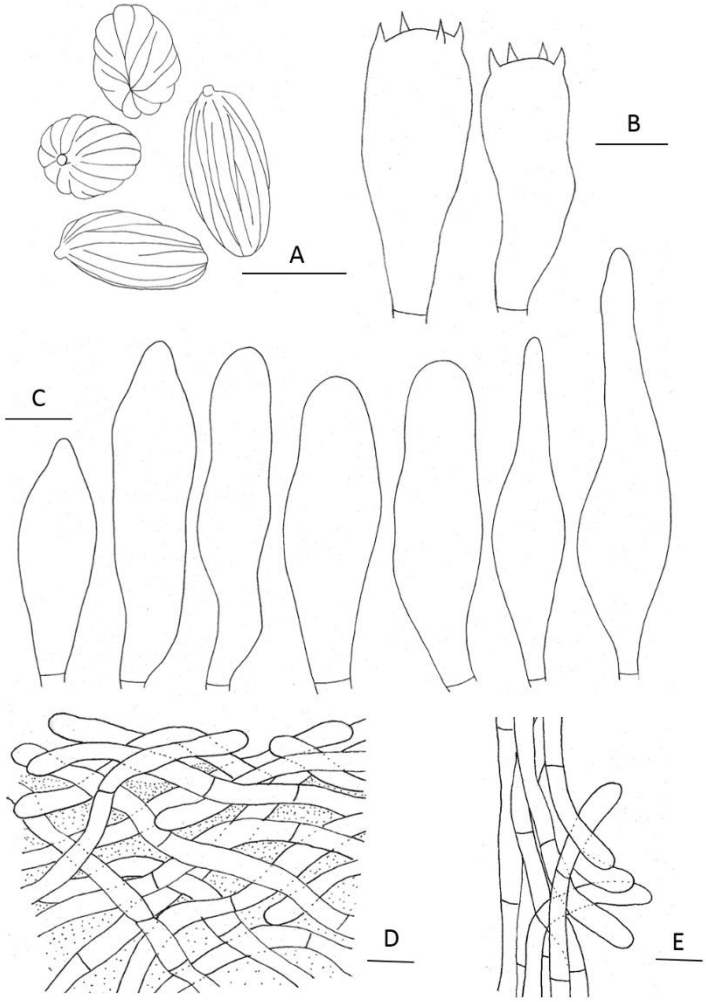

Figure 1: Microcharacters of *Boletellus ananas* (M.A. Curtis) Murrill. **A-**Basidiospores; **B-**Basidia; **C-**Cystidia; **D-**Pileipellis; **E-**Stipitipellis (DLK 380). Bar (A, B, C, D, E) = 10 µm.

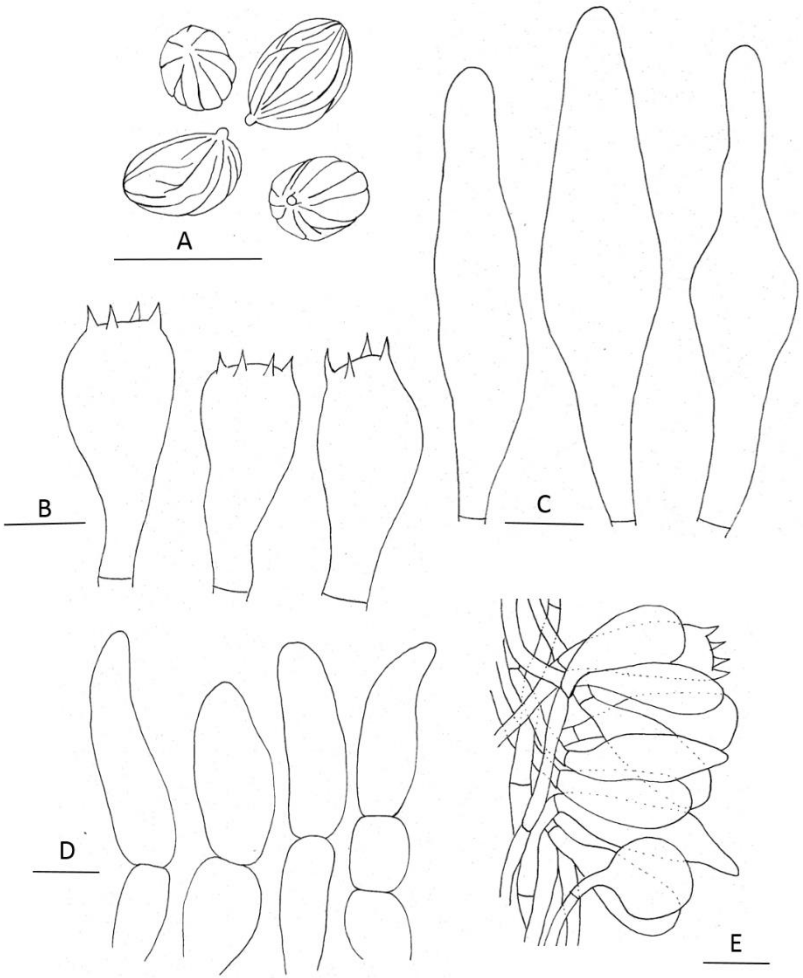

Figure 2: Microcharacters of *Boletellus* cf. *lepidospora* E.-J. Gilbert ex Heinem. **A**-Basidiospores; **B**-Basidia; **C**-Cystidia; **D**- Terminal hyphae from the pileipellis; **E**- Stipitipellis (MAN 502). Bar (A, B, C, D, E) = 10 µm.

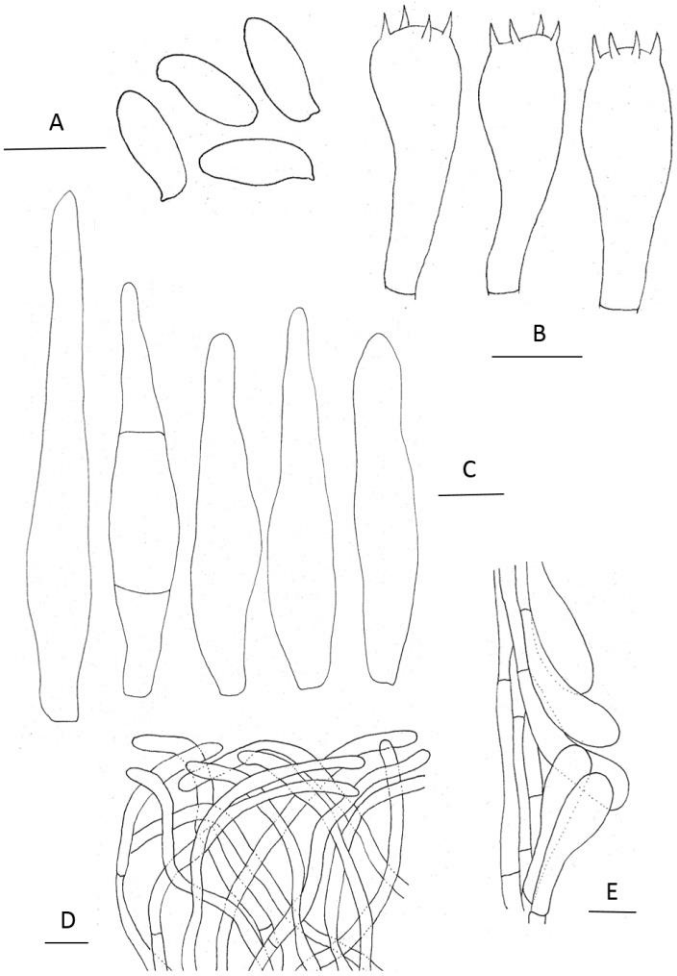

Figure 3: Microcharacters of *Chalciporus trinitensis* var. *amazonicus* L. D. Goméz. **A-**Basidiospores; **B-**Basidia; **C-**Cystidia; **D-**Pileipellis, **E-**Stipitipellis (ACM 492). Bar (A, B, C, D, E) = 10 µm.

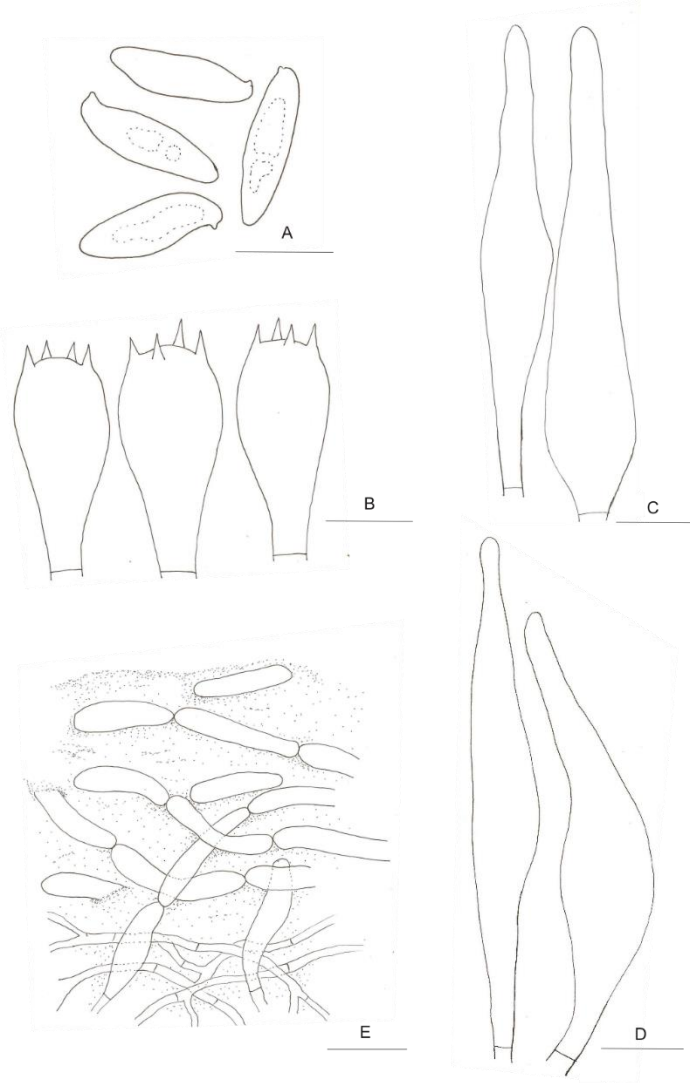

Figure 4: Microcharacters of *Fistulinella* sp. 1. **A**-Basidiospores; **B**-Basidia; **C**-Pleurocystidia; **D**-Cheilocystidia, **E**-Pileipellis (ACM 491). Bar (A, B, C, D, E) = 10 μm.

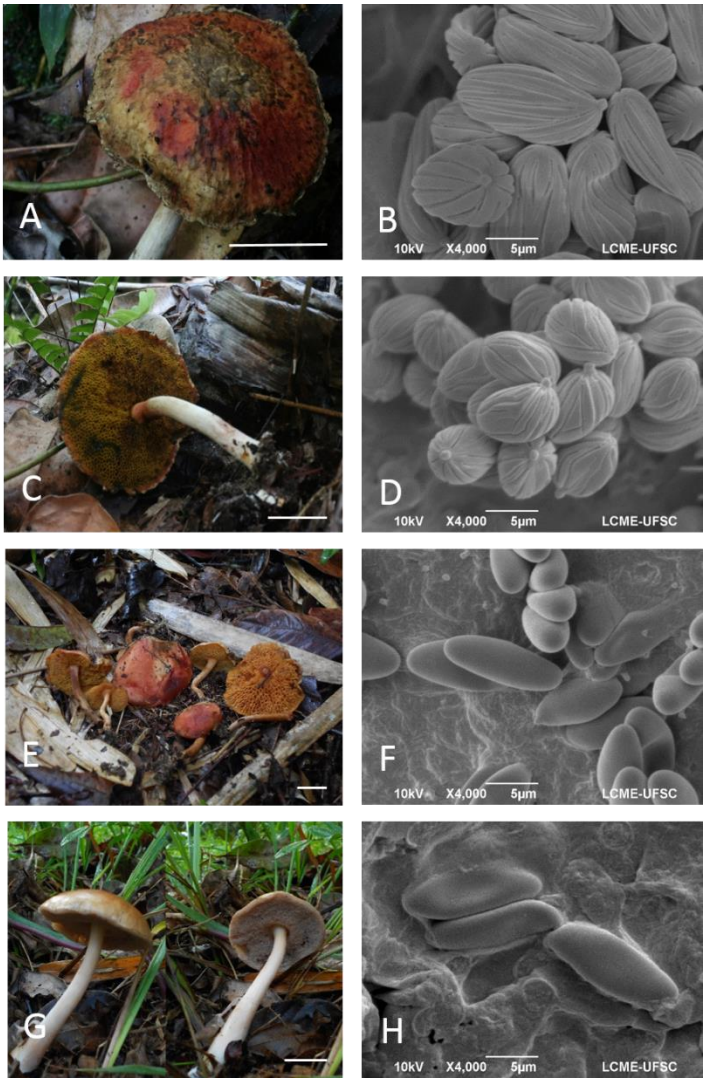

Figure 5: Photographs of the basidiomes in the field, and Scanning Electron Microscopy of the basidiospores. **A,B,C-** *Boletellus ananas* (M.A. Curtis) Murrill; **D-** *Boletellus* cf. *lepidospora* E.-J. Gilbert ex Heinem.; **E,F-** *Chalciporus trinitensis* var. *amazonicus* L. D. Goméz; **G,H-** *Fistulinella* sp. 1. (Bar A, C, E, G = 2.5 cm).

5. CONSIDERAÇÕES FINAIS

Este trabalho amplia as pesquisas de Boletaceae para o Brasil, fornecendo informações importantes sobre a diversidade dos táxons e sua distribuição, após aproximadamente três décadas de ausência de novas coletas e estudos sistemáticos sobre o grupo.

Tylopilus balloui e *F. cinereoalba* foram registradas pela primeira vez para o Brasil. *Austroboletus. festivus* e *C. trinitensis* var. *amazonicus* foram registrados pela primeira vez para Santa Catarina e Espírito Santo respectivamente, e sete novas espécies foram propostas para a ciência (*T. dimorphicus, T. nigrostipitatus, T. pygmaeus, T. versiformis, F. alboaurantiaca, F. conduruensis, F. rhytidocystidiata*). Esses resultados reforçam afirmativas recentes (Henkel 1999, 2001; Halling & Mueller 2001; Halling & Amtoft 2002; Halling et al. 2008; Neves & Halling 2010; Neves et al. 2010) de que Boletaceae é altamente diversa nas regiões tropicais e que propõem a mudança de paradigma que foi aceita por anos devido à escassez de estudos e coletas em várias regiões tropicais, incluindo o Brasil. Consequentemente, acreditamos que a partir do incremento do número de expedições de coleta e da ampliação de áreas de coleta, muitas novas espécies de Boletaceae ainda poderão ser propostas, além de gerar uma ampliação na distribuição geográfica das espécies já conhecidas.

Os gêneros *Tylopilus* e *Fistulinella* apresentam certas similaridades macroscópicas, como a coloração esbranquiçada a rósea do himenóforo e rósea amarronzada da esporada; desta forma, as características microscópicas passam a auxiliar nas identificações, como o tamanho e forma dos esporos. No entanto algumas vezes não há um enquadramento perfeito na circunscrição dos gêneros, uma vez que as espécies neotropicais são, em sua maioria, desconhecidas ou pouco estudadas, sendo esperado que não se enquadrem exatamente nas circunscrições propostas para as regiões temperadas.

As características moleculares, embora não abordadas nesse trabalho, devem ser estudadas e os dados de espécimes neotropicais devem ser incluídos nos estudos filogenéticos futuros a fim de saber como as espécies neotropicais se encaixarão nas hipóteses filogenéticas existentes. A ampliação do estudo filogenético incluindo dados tanto morfológicos quanto moleculares possibilitará a geração de uma circunscrição mais completa dos táxons.

Em relação às espécies descritas por Rolf Singer em regiões da Amazônia na década de 80 e depositados no Herbário INPA, muitas espécies apresentam apenas o holótipo e a maioria está em estado precário de conservação. Desta forma, torna-se necessário um estudo aprofundado dos boletáceos da região Amazônica incluindo novas coletas nas áreas onde foram coletados os tipos para que novas coleções de referência dos táxons amazônicos possam ser comparadas e incorporadas ao herbário.

Uma das grandes demandas no país a respeito dos estudos com boletáceos e de outros grupos de fungos, seria as relações ectomicorrízicas nas florestas brasileiras nativas. Uma vez que aproximadamente 90% das espécies de

plantas realizam esse tipo de associação com fungos micorrízicos e tais informações são pouco documentadas na literatura, a coleta de material e a ampliação do conhecimento no que diz respeito aos hospedeiros é muito importante para conhecermos melhor o equilíbrio das comunidades vegetais, o que ajudaria também nos processos de reflorestamento e conservação dos biomas.

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