Cystoderma, *Cystodermella* and *Ripartitella* in Atlantic Forest, São Paulo State, Brazil

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ABSTRACT - (*Cystoderma*, *Cystodermella* and *Ripartitella* in Atlantic Forest, São Paulo State, Brazil). This paper reports on the genera *Cystoderma*, *Cystodermella* and *Ripartitella* from Atlantic Rainforest, Southeast Brazil. They are represented by *Cystoderma chocoanum*, *Cystodermella contusifolia*, *C. sipariana* and *Ripartitella brasiliensis*. *Cystoderma chocoanum* is reported for the first time outside the type locality (Colombia) and its relationship with others species of *Cystoderma*, based on nLSU rDNA sequences, is discussed.
Key words: Basidiomycota, diversity, molecular analysis, taxonomy

RESUMO - (*Cystoderma*, *Cystodermella* e *Ripartitella* em Mata Atlântica, São Paulo, Brasil). Este trabalho reporta a ocorrência dos gêneros C*ystoderma*, *Cystodermella* e *Ripartitella* para Mata Atlântica, São Paulo, Brasil. Foram registrados *Cystoderma chocoanum*, *Cystodermella contusifolia*, *C. sipariana* e *Ripartitella brasiliensis*. *Cystoderma chocoanum* é registrada pela primeira vez fora da localidade tipo (Colômbia) e sua relação com outras espécies de *Cystoderma*, baseadas em seqüências de nLSU DNAr, é discutida.
Palavras-chave: análise molecular, Basidiomycota, diversidade, taxonomia

Introduction

The species from genus *Cystoderma* Fayod was separated in two distinct genera, *Cystoderma s. str.* and *Cystodermella* by Harmaja (2002), considering the amyloidity of basidiospores; previously unused differences or tendencies present in the genus, like 'harpoon' cystidia, arthrospores in fruit body and/or mycelium culture, liability to *Squamanita*, bryophily; nuclear DNA content, and the results of phylogenetic analysis. The phylogenetic analysis clusters *Cystodermella* close to *Ripartitella* Singer and *Cystoderma* to *Floccularia* Pouzar [*F. albolanaripes* (G.F. Atk.) Redhead].

Ripartitella was erected by Singer (Singer 1947) as a monotypic genus close to *Cystoderma* with the species *R. squamosidisca* (Murrill) Singer. According to Singer (1946) the two genera differ in three important characteristics: the covering layer structure of pileus and stipe, which is an epithelium in *Cystoderma* and a trichodermium in *Ripartitella*; the spore wall, always smooth in *Cystoderma* and echinulate in *Ripartitella*, and the eccentric position of the stipe in a large number of basidioma of *Ripartitella,* whereas *Cystoderma* is centrally stipitate. Singer (1949) considered only one species in the genus, reducing *R. squamosidisca* to synonym of *R. brasiliensis* (Speg.) Singer. The late species was based on *Pleurotus brasiliensis* Speg. collected in Apiaí, São Paulo State, by Puiggari (Spegazzini 1889). Later, *R. sipariana* (Dennis) Dennis (Dennis 1970), *R. ponderosa* (A.H. Sm. & Singer) Franco-Mol. (Franco-Molano 1993) and *R. alba* Halling & Franco-Mol. (Halling & Franco-Molano 1996) were added to the genus. Of these species, *R. sipariana* has smooth basidiospores, which exclude it from *Ripartitella* and is better classified under *Cystodermella*, since the basidiospores are also inamyloid. Halling & Franco-Molano (1996) demonstrated that *Cystoderma ponderosa* A.H. Sm. & Singer has ornamented spores and no sphaerocytes at the pileipellis.

Singer (1986) classified *Cystoderma* and *Ripartitella* in tribus *Cystodermateae* family Agaricaceae. However other authors as Thoen (1969), Heinemann & Thoen (1973) and Harmaja (1979) considered *Cystoderma* in Tricholomataceae without mention on *Ripartitella* while Pegler (1983) considered *Cystoderma* in Agaricaceae following Singer (1986) and *Ripartitella* in Tricholomataceae. The first published paper with molecular data (Johnson

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& Vilgalys 1998) suggested the exclusion of tribus *Cystodermateae* from the family Agaricaceae, which was followed by Kirk *et al*. (2001). In further studies (Moncalvo *et al*. 2002) *Ripartitella* and *Cystoderma* (including *C. granulosum* transferred to *Cystodermella*) remained outside the clade Agaricaceae and the family Tricholomataceae was split in several clades without the presence of *Ripartitella*, *Cystoderma* and *Cystodermella*. The last edition of the "Dictionary of the Fungi" (Kirk *et al*. 2008) considers the three genera in Agaricaceae with the observation that studies with more species of these genera are required before they can be addressed to a definitive family.

The three genera occur in São Paulo State, with *Cystoderma amianthinum* (Bononi *et al*. 1981, Capelari 1989, Pegler 1997); *Cystodermella contusifolia* (Pegler) Harmaja (Capelari 1989, Pegler 1997, as *Cystoderma contusifolium*), *C. sipariana* (Pegler) Harmaja (Pegler 1997, as *Cystoderma siparianum*) and *Ripartitella brasiliensis* (Spegazzini 1889, Grandi *et al*. 1984, Pegler 1997). Recently Wartchow *et al*. (2007) cited *R. alba* and *R. brasiliensis* from Pernambuco State.

In this paper the specimens belonging to these genera from Herbarium SP were revised, including a recent collection of a *Cystoderma* species that resembles *C. amianthinum*. The molecular analysis of the nLSU gene was also made, with the aim of ordering the Brazilian species and its relationship with *C. amianthinum*, a species essentially from temperate, not tropical region (Heinemann & Thoen 1973).

Material and methods

Sampling - The studied material was collected at Parque Estadual das Fontes do Ipiranga (PEFI), a forest reserve in the south of São Paulo City (23°39'S and 46°37'W), Reserva Biológica de Paranapiacaba (RBP), in Santo André City (23°46'S and 46°37'W), both remainings of Atlantic Rainforest in urban area, and Parque Estadual da Ilha do Cardoso, in the south of São Paulo State (25°10'S and 48°W), a preserved Rainforest.

Morphological study - The microscopic analysis was made from dried material rehydrated in 70% ethanol, followed by 5% KOH and Melzer's reagent. The Q_m represents the mean length/width quotient of the total spores measured. The colours of fresh material were compared with Küppers (1979) and specimens are deposited at Herbário do Estado Maria Eneyda P. Kauffmann Fidalgo (SP).

Molecular study - The nLSU rDNA sequences were used for phylogenetic analysis, in order to elucidate the relationship of *C. chocoanum* found in São Paulo, Brazil with sequences deposited in the GenBank (table 1).

DNA extraction - Procedures for DNA extraction were according to an adapted protocol of Ferreira & Grattapaglia (1995) using lyophilized basidiomata previously grounded to a fine powder in liquid nitrogen. The sample was resuspended in 50 µL of TE, incubated at 37 °C for 30 min after the addition of RNase A (0.01 mg μL^{-1}) and stored at -20 ºC.

PCR amplification and DNA sequencing - The 5' end of the nLSU rDNA was targeted for amplification. The nLSU region was amplified using the primer set LR16 and LR0R (Moncalvo *et al*. 2000). PCR reaction, containing 0.5 U of Platinum® *Taq* DNA Polymerase - Brazil (Invitrogen, São Paulo City, SP, Brazil), 0.2 mM of each dNTP, 1 mM of $MgCl_2$, 1% of polyvinylpyrrolidone (Sigma, St. Louis City, MO, USA) and 0.1 µM of each primer of the selected region in 50 µL, was performed in a Progene (Techne, Staffordshire, UK) thermocycler. The program was initiated by a 5-min denaturation step at 92 °C, followed by 40 cycles of 40 sec at 92 °C, 90 sec at 40 °C and 2 min at 72 °C. The polymerization was completed by a 5-min incubation at 72 °C. Amplification products were electrophoresed in a 1.5% agarose gel containing 0.1 µg mL^{-1} ethidium bromide. PCR products were then purified using PureLink PCR Purification Kit (Invitrogen, São Paulo City, SP, Brazil).

DNA sequencing reactions were performed with the Applied Biosystems (ABI) BigDye Terminator Cycle Sequencing Kit v.3.1. in an ABI Prism 377 automated DNA sequencer (Applied Biosystems, Foster City, CA, USA) according to the manufacturer's instruction. The sample was sequenced in both directions with the same primers. The sequence was deposited in the GenBank.

Data analysis - Initially, a blast search was conducted in the GenBank to compare the sequence of *C. chocoanum* with the existing sequence data. Phylogenetic analysis was done using nLSU sequence determined in this study with nine sequences available in the GenBank (table 1).

The sequences were analyzed using BioEdit version 7.0.5.3 (Hall 1999) and then automatically aligned in Clustal W (Thompson *et al*. 1994). The alignment was deposited in the TreeBase. Parsimony analysis was performed with PAUP version 4.0b10 (Swofford 2001). Most parsimonious tree was

Table 1. Collection data and GenBank accession number of the taxa analyzed.

Species	Culture/herbarium nº	Locality	GenBank nº	Reference
Cystoderma amianthinum	TUB 011551		DQ071703	Garnica *et al*. 2007
	JFA 12566	Sweden	DQ154108	GenBank
	GLM 45916	Germany	AY207195	Walther *et al*. 2005
	DAOM 188121		AF261473	Moncalvo *et al*. 2002
	GG_BM05B	United Kingdom	EF535265	Matheny *et al*. not published
C. chocoanum	NY-EFM629	Colombia	U85302	Johnson & Vilgalys 1998
	SP393641	Brazil	EU727143	this paper
C. granulosum	BPI 752511	United States	U85299	Johnson & Vilgalys 1998
C. jasonis	GLM 45917	Germany	AY207196	Walther *et al*. 2005
Ripartitella brasiliensis	NY-EFM 744	Colombia	U85300	Johnson & Vilgalys 1998
Lepiota cristata	DA-45[a]	Germany	AF391071	Vellinga 2001

obtained by heuristic searches with simple sequence addition in 1,000 replicates, employing tree-bisection-reconnection (TBR) branch-swapping algorithm. Characters from the extreme 5` and 3` ends of the sequences were deleted from all taxa to obtain individual datasets that had identical start and end positions, gaps were treated as missing, all characters were unordered and equally weighted, multistate taxa interpreted as uncertainty, starting trees obtained via stepwise addition, one tree held at each step during stepwise addition, steepest descent option not in effect, initial MaxTrees was set to auto-increase, branches of zero length were collapsed (creating politomies), and MulTrees options in effect.

Branch and branch node supports were determined using 1,000 bootstrap replicates. Estimated levels of homoplasy and phylogenetic signal (retention and consistency indexes) were determined. Trees generated were rooted to *Lepiota cristata* Barla as the outgroup taxa.

Results and Discussion

Molecular analysis - Ten taxa plus the outgroup *Lepiota cristata* were aligned. The alignment dataset consisted of 1,480 characters, including gaps. Prior to analysis, 859 characters from 5' and 3' ends of the sequences were excluded. Out of the 621 characters included in the analysis, 279 characters were constant, 307 variable characters were parsimony-uninformative and 35 were parsimony informative.

The heuristic searches with 1,000 bootstrap replicates resulted in one most parsimonious tree, with the following scores: tree length = 374 steps, consistency index = 0.968, retention index = 0.806, rescaled consistency index = 0.781, homoplasy index = 0.032.

The parsimony tree generated from nLSU sequence data using species of *Cystoderma* and *Ripartitella* revealed two major clades (figure 1). The upper clade, clustered *C. granulosum* and *R. brasiliensis* with 83% of bootstrap support. This was demonstrated before by Moncalvo *et al*. (2002) and utilized by Harmaja (2002) to create the genus *Cystodermella* segregated from *Cystoderma*. Meanwhile, all other species of *Cystoderma* appears in the lower clade separated into two groups with 77% of bootstrap support. *Cystoderma chocoanum* from Brazil appears in the first group with *C. chocoanum* from Colombia, in a clade with 100% of bootstrap support. It shows that the Brazilian species belongs to *C. chocoanum*, also confirmed by the morphological analysis. *C. jasonis* and *C. amianthinum* clustered in the second group.

In the analysis of Moncalvo *et al*. (2002), *Floccularia albolanaripes* (G.F. Atk.) Redhead (GenBank AF261380) appears as a sister group of *Cystoderma* with a low bootstrap support (< 50%). They presented no explanation for this fact because there are no obvious morphological relations between the two genera. This sequence appeared in the blast search made with the sequence of *C. chocoanum* obtained for this study, and, when added to the dataset analyzed, *F. albolanaripes* appears in the *Cystoderma* clade with a bootstrap support of 58% (data not shown).

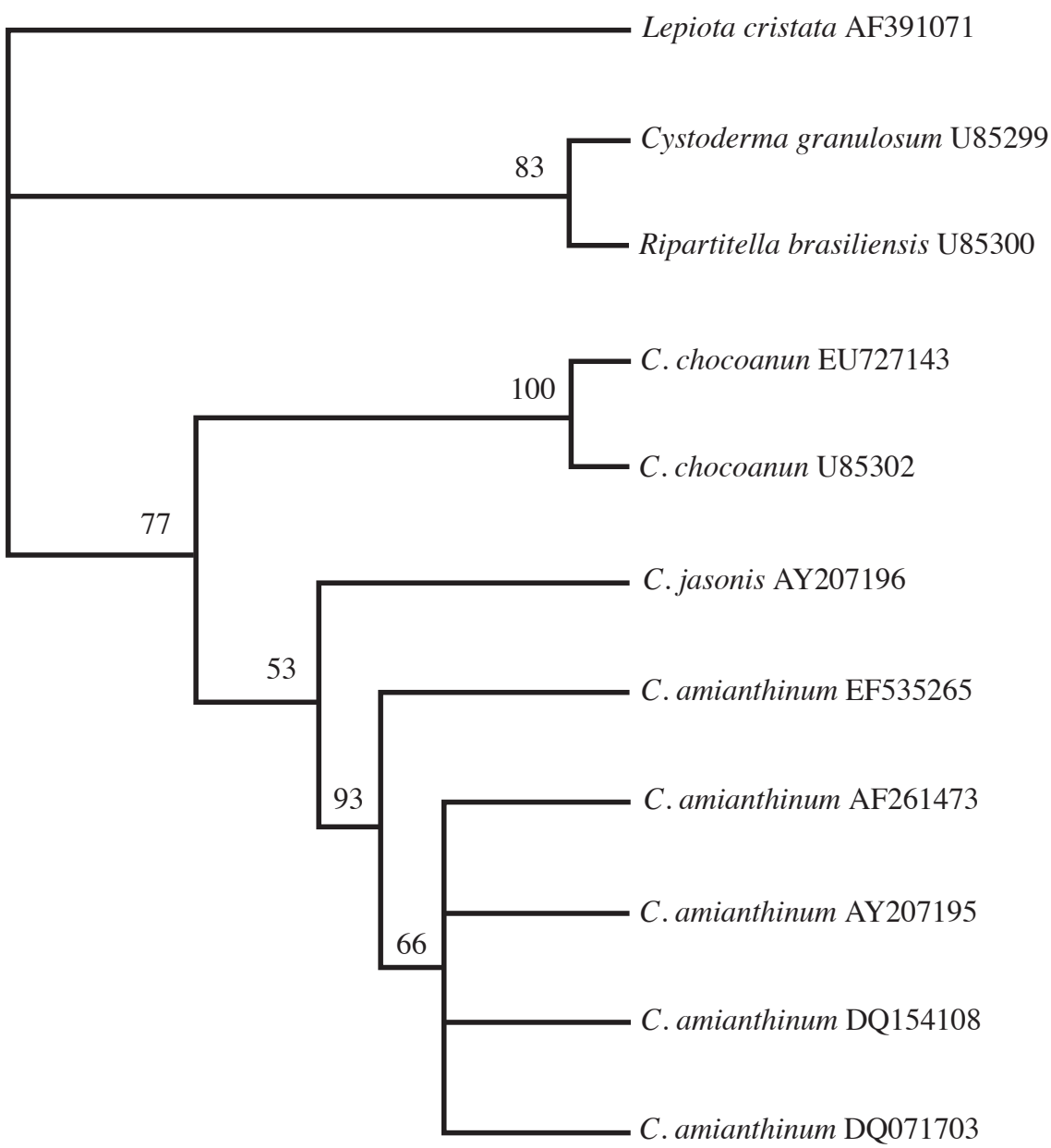

Figure 1. Cladogram generated by parsimony analysis of partial LSU rDNA sequences. Bootstrap values ≥ 50% are shown above branches. GenBank accession numbers are shown after each taxon name.

Floccularia Pouzar (Pouzar 1957) was placed in Amanitaceae mainly because of the bilateral lamellar trama and amyloid basidiospores. It comprises six species distributed in the United States and Europe, and *F. albolanaripes* is the only species with sequence in the GenBank. This species, according to Mitchel & Smith (1976, as *Armillaria albolanaripes* G.F. Atk.) does not have divergent hyphae in lamellar trama, has weakly amyloid basidiospores and do not have any kind of sphaerocytes at the pileipellis.

In another molecular analysis where *Cystoderma* species were included (Johnson & Vilgalys 1998, Walther *et al*. 2005, Matheny *et al*. 2006), *Floccularia* was not considered. For a better resolution of *Cystoderma* and *Cystodermella* containing clade, a larger sampling including other North American and European species of *Floccularia* is necessary, since the introduction of *F. albolanaripes* changes the relations among the two genera, and because they are morphologically very distinct.

Taxonomy - This key presents only the species studied. Identification keys for other species can be found in Smith & Singer (1945), Thoen (1969), Heinemann & Thoen (1973) and Saar (2003).

1. Basidiospores echinulate, pileipellis a trichodermium ..... *Ripartitella brasiliensis*
1. Basidiospores smooth, pileipellis an epithelium with sphaerocytes
   2. Pileus orange-brown to golden-brown, basidiospores amyloid ... . *Cystoderma chocoanum*
   2. Pileus whitish, basidiospores inamyloid
      3. Pleurocystidia absent .... Cystodermella contusifolia
      3. Pleurocystidia present .... Cystod*ermella sipariana*

Cystoderma chocoanum Franco-Mol., Mycologia 85: 673. 1993.

Figure 2 a-d

Pileus (8-)20–40 mm diam., convex to applanate, surface dry, orange-brown ($N_{40}A_{70}M_{50}$) to golden-brown, with a darker centre ($N_{60}A_{99}M_{60}$), covered by small squamules, that leaves a pruinose aspect to the pileus, membranous, not hygrophanous, margin appendiculate, involute when young, applanate to revolute when well developed. Lamellae adnexed, subdecurrent to slightly decurrent, white to whitish, crowded, with lamellulae of four lengths, margin entire. Stipe 25-55 × < 1-5 mm, cylindrical, slightly subbulbous at the base, sometimes flexuous or napiform, tough, white to yellowish at the apex, above the annulus, deep brown to blackish towards the base, under the annulus, covered by a layer of whitish tissue similar to the tissue forming the annulus, solid. Annulus flaring, superior, whitish, as a result of the sheet that recovers the stipe. White basal mycelium at the base. Context white, very thin. Spore print white to beige with some brownish spots. Basidiospores (5-)6-7.2 × (2.5-)3.7-4 μm, (Q_m = 1.7), ellipsoid, smooth, thin-walled, hyaline, strongly amyloid, without germ pore. Basidia 21.2-22.5 × 7 μm, clavate, hyaline, thin-walled, with four sterigmata, with internal content. Basidioles present, similar to basidia. Pleurocystidia absent. Cheilocystidia absent, lamellae margin fertil. Context hyaline, thin, formed of hyaline, thin-walled, septated hyphae, with clamp-connexions, 3.5-7.5 μm diam., less condensed near the pileipellis. Hymenophoral trama regular, hyaline, of thin-walled, hyaline, septated hyphae, with clamp-connexions, 3.7-11.2 μm diam., some slightly inflated. Pileipellis composed of chains of brownish sphaerocytes, globose, some with a small papillae, 27.5-40 μm diam., with thin to thick wall, vacuolar content, without evident reddening in KOH. Annulus tissue composed by hyaline hyphae, 5-7.5 μm diam., branched and interwoven, slightly thick-walled, septated, with clamp-connexions, ending in a chain of globose cells, hyaline to brownish-pigmented, with minute clamp-connexions, terminal elements 18.7-38.7 × 13.7-20 μm.

Habitat: Gregarious to caespitose on decaying wood.

Known distribution: Brazil (Bononi *et al*. 1981, Capelari 1989, Pegler 1997), Colombia (Franco-Molano 1993).

Material examined: BRAZIL. São Paulo: Cananéia, Parque Estadual da Ilha do Cardoso, hillside of Morro dos Três Irmãos, 28-VIII-1984, *M. Capelari 157* (SP); idem, left side of Santa Cruz River, 30-I-1985, *M. Capelari 267* (SP); idem, Morro das Almas, 30-X-1985, *M. Capelari et al. s.n.* (SP194003); Santo André, Reserva Biológica de Paranapiacaba, 1-IV-1992, *L.K. Okino et al. 306* (SP); idem, trail n. 2, 20-IV-2006, *F. Karstedt & M. Capelari 620* (SP).

Additional material examined: BRAZIL. Rondônia: Jaru, 9°15'S - 61°40'W, 15-X-1986, *M. Capelari & R. Maziero 1164* (SP).

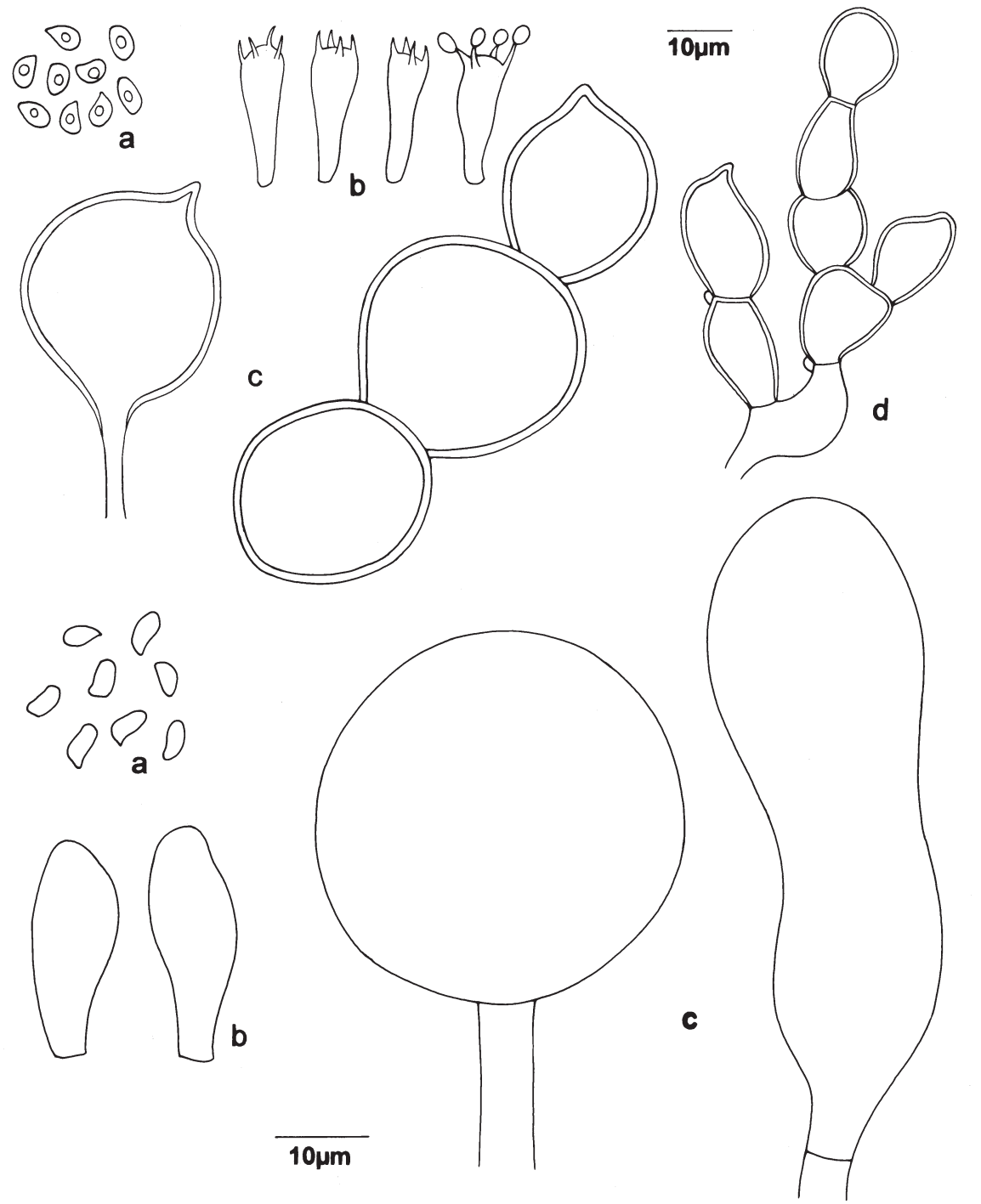

Figure 2. a-d. *Cystoderma chocoanum*. a. Basidiospores. b. Basidia. c. Elements of pilear surface. d. Elements of the annulus. e-g. *Cystodermella contusifolia*. e. Basidiospores. f. Cheilocystidia. g. Elements of pilear surface.

Little morphological differences were observed between the Brazilian material and the original description for the Colombian material (Franco-Molano 1993). Macroscopically the pileus surface of the Brazilian collections is not areolate and the lamellae attachment is more decurrent than mentioned by Franco-Molano (1993). The basidiospores have comparable dimensions, but the pear-to-kidney shape mentioned was not observed in the Brazilian collections, all samples were ellipsoid. The others characteristics are in accordance.

Cystoderma chocoanum was previously registered from Brazil as *C. amianthinum* by Bononi *et al.* (1981), Capelari (1989) and Pegler (1997). The citations of *C. amianthinum* made by Singer (1969) for Argentine, Chile and Bolivia, and by Dennis (1961) for Venezuela, probably also represent *C. chocoanum* or another species, since, at least once, Singer (1969) said that the South American collections are close to the typical *C. amianthinum*, with differences at pileus surface and basidiospores.

Cystoderma austrofallax Smith & Singer, described from Chile is also close to *C. chocoanum*, differing in the pileus colour and small basidiospores (3.5-5 × 3 μm), strongly amyloid reaching a violaceous colour and a strong reaction of the pilear surface to intense ferruginous-orange with KOH (Singer 1969).

Molecular analysis with the North and South American species of *Cystoderma* will be necessary to show the relations between *C. fallax*, already mentioned by Franco-Molano (1993) as close to *C. chocoanum*, *C. austrofallax* and the others South American species, in order to confirm the presence of *C. amianthinum* in South America.

Cystodermella contusifolia (Pegler) Harmaja, Karstenia 42: 46. 2002 ≡ *Cystoderma contusifolium* Pegler, Kew Bull. add. ser. 9: 410. 1983.

Figure 2 e-g

Pileus 20-40 mm diam, conic to campanulate, expanding, surface whitish, covered with verrucose to pyramidal brownish squamules especially at the disk, non-striate, not hygrophanous, margin smooth. Lamellae adnexed, whitish, crowded, with lamellulae of two lengths, margin entire. Stipe 20-55 × 2-4 mm, cylindric, uniform, solid, whitish, surface pruinose to weakly squamulose, squamules concolorous. Annulus absent. Context white, thin. Spore print not seen. Basidiospores 3.6 × 2.4 μm (Q_m = 1.5), ellipsoid, smooth, thin-walled, hyaline, inamyloid, without germ pore. Basidia not observed. Pleurocystidia absent. Cheilocystidia 19.2-21.6 × 7.2 μm, ventricose, thin-walled, hyaline. Context hyaline, thin, formed of hyaline, thin-walled septated hyphae, with clamp-connexions, 3.6-8.4 μm diam. Hymenophoral trama regular, hyaline, of thin-walled septated hyphae, with clamp-connexions, 8.4-9.6 μm diam. Pileipellis an epithelium of detersile sphaerocytes 36-60 μm diam., subglobose to globose, with brownish wall and pale-brownish vacuolar content.

Habitat: on soil.

Known distribution: Brazil (Capelari 1989), Martinique (Pegler 1983).

Material examined: BRAZIL. São Paulo: Cananéia, Parque Estadual da Ilha do Cardoso, trail to Morro das Almas, 30-X-1985, *M. Capelari 450* (SP).

This species was described based on material collected in Martinique. The Brazilian material agrees with the original description, except for pileus colour, that is very pale ochraceous, and the slightly bigger cheilocystidia (18-38 × 4-10 μm) mentioned by Pegler (1983). The identification of the Brazilian material was confirmed by Dr. Pegler and, as far as we know, it is represented only by the type and this collection.

Cystodermella sipariana (Dennis) Harmaja, Karstenia 42: 46. 2002 ≡ *Lepiota sipariana* Dennis, Kew Bull. 7: 488. 1953 ≡ *Cystoderma siparianum* (Dennis) Thoen, Bull. Jard. Bot. Nat. belg. 39: 190. 1969 ≡ *Ripartitella sipariana* (Dennis) Dennis, Kew Bull. Addit. Ser. 3: 58. 1970.

Description: See Pegler (1983).

Habitat: on soil of "restinga" vegetation.

Known distribution: Brazil (Pegler 1997), Trinidad (Dennis 1953, 1970).

Material examined: BRAZIL. São Paulo: Cananéia, Parque Estadual da Ilha do Cardoso, Restinga do Pereirinha, 9-I-1990, *M. Capelari et al. 3010* (SP).

Pegler (1983) presents a description of this species and the only material that could be assigned to it, present at Herbarium SP, is completely contaminated by molds. Few observations were recovered. The pileipellis has sphaerocytes peculiar to *Cystodermella*, and basidiospores are smooth and inamyloid.

Pegler (1997) cited four Brazilian materials under this species. From them, SP193723, also from Parque

Estadual da Ilha do Cardoso is *Lepiota abruptibulba* Murrill (Capelari 1989) as mentioned under this late species (Pegler 1997, p. 38). The two materials from Parque Estadual de Campos do Jordão were not found at Herbarium SP and the last (Capelari *et al*. 3010) is very moldy. Until now the species has not been found again.

Ripartitella brasiliensis (Speg.) Singer, Lilloa 22: 452. 1951 ≡ *Pleurotus brasiliensis* Speg., Bull. Acad. Nac. Cienc. Cordoba, 11: 398. 1889.

= *Marasmius squamosidiscus* Murrill, Bull. Torrey Bot. Club 67: 151. 1940 ≡ *Ripartitella squamosidisca* (Murrill) Singer, Mycologia 39: 85. 1947.

= *Lentodium floridanum* Murrill, Mycologia 35: 426. 1943.

= *Collybia pseudoboryana* Dennis, Trans. Brit. Mycol. Soc. 34: 453. 1951.

= *Lepiota armillarioides* Dennis, Kew Bull. 7: 486. 1952.

Figure 3

Pileus 14-35 mm diam., applanate to somewhat depressed at the centre, white with brown to reddish brown squamules, dense in the centre and diminishing towards the margin; when young the squamules cover all the surface, fleshy, not hygrophanous, margin ondulate, sometimes revolute, appendiculate. Lamellae adnexed to sinuated, white, crowded, with lamellulae. Stipe 16-50 × 1.7-3 mm, central, sometimes tapered towards the base, apex somewhat flattened, white at the apex, above the annulus, beige under annulus, fibrillose to squamulose, squamules whitish to brownish. Annulus evanescent, white. Spore print white. Context white, thin. Basidiospores minute, 3.7-4 × 3 μm (Q_m = 1.3), subglobose, echinulate, hyaline, thin-walled, inamyloid. Basidia 25-27.5 × 6.2-7.5 μm, clavate, hyaline, thin-walled, with four proeminent sterigma, clamp-connexions present at the base. Pleurocystidia sometimes abundant, 37.5-50 × 2.5-6.2(-8.7) μm, cylindrical to lageniform, hyaline, thin-walled, with incrustations dissolving in KOH. Cheilocystidia absent. Context hyaline, thin, formed of hyaline, thin-walled, septated, sometimes inflated hyphae, sometimes branched, interwoven, with minute clamp-connexions 3.7-7.5(-18.7) μm diam. Hymenophoral trama irregular, hyaline, of thin-walled, hyaline, septated hyphae, with minute clamp-connexions, 6.2-8.7 μm diam. Subhymenium slightly dextrinoid. Pileipellis a trichodermium, sometimes with globose detersile elements, brownish, 22.5-25 μm diam., from the pilear squamules.

Habitat: gregarious to caespitose, on soil.

Known distribution: Bolivia, Bonin Islands (Ovrebo 1988), Brazil (Spegazzini 1889, Grandi *et al*. 1984, Pegler 1990, 1997, Meijer 2001), Colombia (Ovrebo 1988), Kenya (Pegler 1977), Martinique (Ovrebo 1988), Mexico (Guzmán-Dávalos & Guzmán 1988),

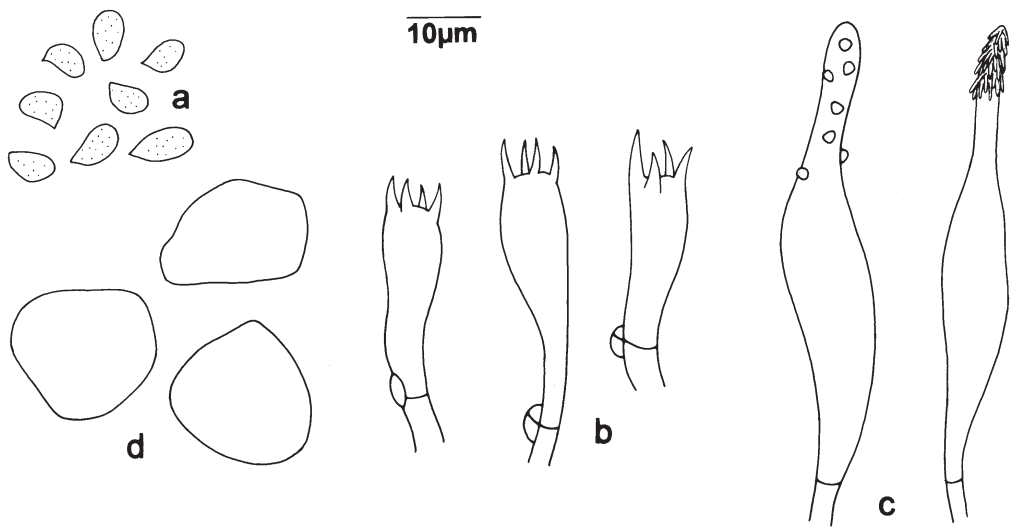

Figure 3. *Ripartitella brasiliensis*. a. Basidiospores. b. Basidia. c. Pleurocystidia. d. Detersile elements of pilear surface.

Tanzania, Trinidad, Uganda (Pegler 1977), United States (Ovrebo 1988).

Material examined: BRAZIL. São Paulo: Santo André, Reserva Biológica de Paranapiacaba, 10-VI-1991, *L.K. Okino 225* (SP); idem, 10-VI-1991, *L.K. Okino 228* (SP); São Paulo, Parque Estadual das Fontes do Ipiranga, in fissure at Seção de Micologia e Liquenologia building, 20-X-1995, *R. Maziero s.n.* (SP393640); idem, 22-I-1996, *L.K. Okino s.n.* (SP215009); idem, 15-II-2008, *F. Karstedt & L.A. Ramos 1077* (SP).

Ripartitella brasiliensis is a well characterized species because of the pileus colour covered with minute squamules ranging from brownish to reddish-brown, sinuated lamellae, size and type of pleurocystidia, visible at stereoscopic microscope, and the characteristic minute echinulate basidiospores. The basidiospore ornamentation is very small and is better visualized with Melzer's reagent with immersion oil.

Ripartitella alba Halling & Franco-Mol., described from Costa Rica is very close to *R. brasiliensis*, differing according to Halling & Franco-Molano (1996) by the less squamulose to glabrous pileus, less and different pigmentation, smaller habit, wider spacing between lamellae, smaller spores, and smaller cystidia of *R. alba*. It is evident in macroscopic appearance of *R. alba*, according to published photographs of type material (Halling & Franco-Molano 1996, Halling & Mueller 2005) that it is quite different from *R. brasiliensis*.

Bandala *et al.* (2005) mentioned *R. alba* as occurring in Mexico. But, by the macroscopic illustrations they presented, the pileus "initially covered with a more or less compact (interrupted), brownish-orange or dull brownish-orange, tomentose-squamulose layer breaking after pileus expansion…", and the absence of cheilocystidia (as in *R. brasiliensis*), it probably represents a collection of *R. brasiliensis*, not *R. alba* [compare also with the photography published by Ovrebo (1988)]. Wartchow *et al.* (2007) mentioned *R. alba* for northeast Brazil.

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