



Notes on *Junghuhnia* (Agaricomycetes) in Brazil

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Received: September 16, 2015

Accepted: March 23, 2016

ABSTRACT

Junghuhnia is a cosmopolitan genus of Agaricomycetes (Basidiomycota), mostly characterized by having a dimitic hyphal system and encrusted cystidia. The genus comprises 37 legitimate species, eight of which have been reported in Brazil. This study provides updated information about the diversity and distribution of *Junghuhnia* in Brazil by reporting *J. semisupiniformis* for the first time from South America, *J. globospora* from Brazil, *J. carneola* from northeastern Brazil and the state of Pará, *J. nitida* from the state of Pernambuco, and *J. subundata* from the state of Amazonas. Descriptions of *J. semisupiniformis* and *J. globospora*, as well a key to the accepted species of *Junghuhnia* from Brazil, are provided.

Keywords: Amazon Forest, Atlantic Forest, Caatinga, Fungi, Polypores

Introduction

Brazil has a large territory mostly located in the intertropical zone and has a hot climate throughout the year. This allows a great diversity of ecosystems ranging from semi-desert to evergreen tropical rain forests. Brazil may be the richest country on earth in biological diversity (Mittermeier *et al.* 2005), including wood-inhabiting fungi. Currently, 5712 fungi are reported to Brazil and much of this fungal diversity is still being listed and constantly updated (<http://www.floradobrasil.jbrj.gov.br/>).

Junghuhnia is a cosmopolitan genus of Agaricomycetes (Basidiomycota) which causes a white rot. It is characterized by annual, resupinate, effused, rarely pileate basidiomata, a dimitic hyphal system, encrusted cystidia, and obovoid to cylindrical basidiospores (Spirin *et al.* 2007; Westphalen *et al.* 2012). The genus comprises 37 legitimate species (<http://www.indexfungorum.org/>; Kirk *et al.* 2008), eight of which were reported in Brazil: *Junghuhnia carneola*, *J. crustacea*, *J. meridionalis*, *J. minuta*, *J. nitida*, *J. polycystidifera*, *J. subundata*

and *J. undigera* (Baltazar & Gibertoni 2009; Westphalen *et al.* 2010; Soares *et al.* 2014a; Gugliotta *et al.* 2015).

Recently, several studies including new species and new records of polypores in Brazil have been published (Baltazar *et al.* 2014; Baldoni *et al.* 2015; Campos-Santana *et al.* 2014; 2015; Motato-Vásquez *et al.* 2014; 2015a; b; Soares *et al.* 2014b; Westphalen *et al.* 2014; Pires *et al.* 2015), but few included species of *Junghuhnia* (Westphalen *et al.* 2010; 2012). In the current study, we present descriptions of *J. semisupiniformis* and *J. globospora* and a key to the accepted species of *Junghuhnia* reported in Brazil. In addition, an update of distribution of some species is provided.

Materials and methods

Specimens were collected in the Amazonic Forest in April 2013, in the Floresta Nacional de Humaitá (7°30'22"S; 63°1'15"W), in the State of Amazonas; in the Atlantic Rain Forest from March 2012 to September 2013 in five remnants in the Reserva Particular do Patrimônio Natural (RPPN) Frei

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Caneca ($8^{\circ}42'37''S$; $35^{\circ}50'01''W$) and one in the Reserva Biológica de Saltinho ($8^{\circ}39'18''S$; $38^{\circ}1'46''W$), both in the State of Pernambuco; in the semi-arid region from April 2012 to March 2014 in Parque Estadual Mata do Pau-Ferro ($06^{\circ}58'12''S$; $35^{\circ}42'15''W$), a remnant of montane forest in the State of Paraíba.

Specimens were analyzed macro- (shape, colour, hymenial surface) and micromorphologically (hyphal system, presence/absence and measurements of sterile structures and basidiospores). Slides were prepared with 5% KOH (stained with 1% aqueous phloxine) or Melzer's reagent in order to check for amyloid or dextrinoid reaction (Wu *et al.* 2004). Technical nomenclature followed Fidalgo & Fidalgo (1967) and colour designation followed Watling (1969). For identification, the works of Ryvarden (1991; 2014), Ryvarden & Gilbertson (1993) and Ryvarden & Melo (2014) were utilized. Specimens were incorporated to Herbaria O and URM.

Additionally, reports of species of *Junghuhnia* Corda were surveyed in the databases Specieslink (<http://www.splink.org.br/>) and Lista de Espécies da Flora do Brasil (<http://floradobrasil.jbrj.gov.br/>) and in the literature (Bononi 1992; Almeida-Filho *et al.* 1993; Sotão *et al.* 2002; Baltazar & Gibertoni 2009; Gibertoni & Drechsler-Santos 2010; Westphalen *et al.* 2010; Westphalen *et al.* 2012; Soares *et al.* 2014a).

Results and Discussion

Overall diversity

After field trips, research in the databases and literature, 12 species of *Junghuhnia*, distributed in 12 Brazilian states are recognized (Tab. 1). In this study, we report *J. semisupiniformis* for the first time from South America (in remnants of Atlantic Forest in the State of Pernambuco); *J. globospora* from Brazil; *J. carneola* for the first time from Northeast Brazil (in a montane forest in the State of Paraíba and remnants of Atlantic Forest in Pernambuco) and from the State of Pará (in Amazonic Forest); *J. nitida* from the State of Pernambuco (in remnant of Atlantic Forest) and *J. subundata* from the State of Amazonas (in Amazonic Forest).

Taxonomy

Junghuhnia semisupiniformis (Murrill) Ryvarden, Mycotaxon 23: 195 (1985) (Fig. 1A-C)

≡ *Tyromyces semisupiniformis* Murrill, Bull. New York Bot. Gard. 8: 148 (1912).

Description: Basidiomata: annual, pileate to effused-reflexed, fan-shaped, pileus thin, flexible, papery, $3 \times 4 \times 0.2$ cm. Abhimenial surface: glabrous, azonate, cream to pale brownish yellow (3c to 5e). Hymenial surface pale ochraceus (9h). Pores: angular, thin walled, 5-6 per mm.

Context homogeneous, tube layer concolorous with pore surface, 1 mm thick. Hyphal system: dimitic, generative hyphae with clamps, hyaline, $2.5 \mu\text{m}$ in diam., skeletal hyphae abundant, thick-walled, hyaline to pale yellow, non septate, $2-5 \mu\text{m}$ in diam. Cystidia: abundant in the trama, thin to slightly thick-walled, cylindrical to clavate, apically encrusted, projecting into the hymenium, $70 \times 8 \mu\text{m}$. Basidia: clavate, 4 sterigmata, $20 \times 5 \mu\text{m}$. Basidiospores: smooth, negative in Melzer reagent, ovoid to subglobose, $4-4.5 \times 3-3.5 \mu\text{m}$.

Distribution: This species is widely distributed in the Caribbean area and it is cited from Mexico, Italy, France and Germany (Bernicchia 2005). This is the first report from South America.

Material examined: BRAZIL, Pernambuco, Jaqueira, RPPN Frei Caneca, Mata Barragem das Moças, in decaying hard wood, 3 Jun 2012, leg. G. S. Nogueira-Melo NM158, det. L. Ryvarden (URM 82257); BRAZIL, Pernambuco, Jaqueira, RPPN Frei Caneca, Mata Serra do Quengo, in decaying hard wood, 17 May 2013, leg. G. S. Nogueira-Melo NM630, det. L. Ryvarden (URM 86554); BRAZIL, Pernambuco, Jaqueira, RPPN Frei Caneca, Mata Serra do Quengo, in decaying hard wood, 20 Jul 2013, leg. G. S. Nogueira-Melo NM704, det. L. Ryvarden (URM 87684).

Remarks: *Junghuhnia semisupiniformis* is characterized by a pileate basidiomata and the abundant cystidia in the trama. The specimens analyzed had thin- to slightly thick-walled walled cystidia, while Ryvarden & Gilbertson (1993) described the cystidia as thick-walled. Of the pileate species reported in Brazil, *J. minuta* has the smallest basidiospores among the American pileate species of the genus ($2.5-3 \times 2-2.5 \mu\text{m}$), while *J. undigera*, with similar pore size ($5-7 \mu\text{m}$) and basidiospores shape (broadly ellipsoid to ovoid), has slightly larger basidiospores ($4-5 \times 3.5-4 \mu\text{m}$) and few cystidia in the trama.

Junghuhnia globospora Iturr. & Ryvarden, Synop. Fungorum. 27: 83 (2010)

Description: Basidiomata: annual, resupinate to effused-reflexed, adnate, flexible, $5 \times 7 \times 0.3$ cm. Hymenial surface: cream to pale yellowish (6f to 52buff). Pores: angular, thin walled, 4-5 per mm. Context: concolorous with the pore surface, soft and up to $300 \mu\text{m}$ thick, almost invisible to the naked eyes. Margin: very narrow, smooth, reflexed when dry, concolorous with the pore surface. Hyphal system: dimitic, generative hyphae with clamps, $2.5-3 \mu\text{m}$ in diam., thin-walled, skeletal hyphae thick-walled, hyaline, non septate, $2-3 \mu\text{m}$ in diam. Cystidia: abundant in the trama, thick-walled, cylindrical to club-like, smooth or with few crystals at the top, $40-60 \times 6-8 \mu\text{m}$. Basidia: clavate, 4 sterigmata, basal clamp, $12-15 \times 3-4 \mu\text{m}$. Basidiospores: smooth, negative in Melzer reagent, globose, hyaline, thin-walled, $4-5 \mu\text{m}$ diam.

Distribution: This species was known only from the type locality in Venezuela (Ryvarden & Iturriaga 2010). The current report is the first from Brazil.



Table 1. Brazilian records of species of *Junghuhnia* based on field trips, databases and literature records with locale of occurrence and voucher (not studied)/reference. AC = Acre; AL = Alagoas; AM = Amazonas; AP = Amapá; BA = Bahia; CE = Ceará; PA = Pará; PB = Paraíba; PE = Pernambuco; PR = Paraná; RS = Rio Grande do Sul; SC = Santa Catarina; SP = São Paulo.

Species	State	Reference or voucher	Biome
<i>Junghuhnia carneola</i> (Bres.) Rajchenb.	PB	Present study	Caatinga
	AM	INPA 129588	Amazonic Forest
	PA	Present study	
	PR, RS, SC	Westphalen <i>et al.</i> (2012)	Atlantic Forest
	SP	SP-Fungi 446259	
<i>Junghuhnia crustacea</i> (Jungh.) Ryvarden	AC	Bononi (1992)	Amazonic Forest
	AM	INPA 185882	
	PA	Sotão <i>et al.</i> (2002)	Amazonic Forest (mangrove)
<i>Junghuhnia globospora</i> Iturr. & Ryvarden	PB	Present study	Caatinga
<i>Junghuhnia lacera</i> (P. Karst.) Niemelä & Kinnunen	SP	INPA 186302 (as <i>J. separabilina</i>)	Atlantic Forest – Cerrado (transition zone)
<i>Junghuhnia luteoalba</i> (P. Karst.) Ryvarden	SP	Gugliotta <i>et al.</i> (2015)	Cerrado
<i>Junghuhnia meridionalis</i> (Rajchenb.) Rajchenb.	PR, RS, SC	Westphalen <i>et al.</i> (2010)	Atlantic Forest
	SP	SP-Fungi 446273	
<i>Junghuhnia minuta</i> I. Lindblad & Ryvarden	PR, RS, SC	Westphalen <i>et al.</i> (2012)	Atlantic Forest
<i>Junghuhnia nitida</i> (Pers.) Ryvarden	SP	SP-Fungi 446222	Atlantic Forest
	AL, PR, RS, SP	Baltazar & Gibertoni (2009)	
	PE	Present study	
<i>Junghuhnia polycystidifera</i> (Rick) Rajchenb.	PR, RS, SC	Westphalen <i>et al.</i> (2012)	Atlantic Forest
<i>Junghuhnia semisupiniformis</i> (Murrill) Ryvarden	SP	Almeida-Filho <i>et al.</i> (1993)	Atlantic Forest (mangrove)
	PE	Present study	Atlantic Forest
<i>Junghuhnia subundata</i> (Murrill) Ryvarden	AM	Present study	Amazonic Forest
	AP	Soares <i>et al.</i> (2014b)	
<i>Junghuhnia undigera</i> (Berk. & M.A.Curtis) Ryvarden	CE	URM 80473	Caatinga
	PE	URM 80666	
	PA, PR, RS, SC, SP	Westphalen <i>et al.</i> (2012)	Amazonic Rain Forest, Atlantic Forest
	SP	Gibertoni & Drechsler-Santos (2010)	Cerrado

Material examined: BRAZIL, Paraíba, Areia, Reserva Estadual Mata do Pau-Ferro, in decaying hard wood, 16 Apr 2012, leg. C.R.S. Lira CL627, det. L. Ryvarden (URM 87963).

Remarks: *Junghuhnia globospora* is characterised by the papery, thin and flexible basidiomata and globose basidiospores. *Junghuhnia subundata* is quite similar, but has smaller, subglobose to broadly ellipsoid basidiospores (2.3-3 × 2-2.5 µm) and the pore surface is ochre to pale brownish when dry (Ryvarden & Iturriaga 2010).

Junghuhnia carneola (Bres.) Rajchenb., Revta Investnes agrop. Sér. 5 19(1): 45 (1984)

≡ *Poria carneola* Bres., Hedwigia 35(5): 282 (1896).

Description: Westphalen *et al.* (2012)

Distribution: Tropical and subtropical species. In Brazil, reports are known for the States of Amazonas, Paraná, Santa

Catarina and Rio Grande do Sul (Baltazar & Gibertoni 2009; Gugliotta *et al.* 2015). It is the first record for the State of Pará, Brazilian Northeast and Caatinga Biome.

Material examined: BRAZIL, Pará: Melgaço, Estação Científica Ferreira Penna August 2008, leg. T.B. Gibertoni s.n., det. L. Ryvarden (URM 79633); Paraíba: Areia, Parque Estadual Mata do Pau Ferro, in decaying hardwood, 29 April 2013, leg. C.R.S. Lira CL574, det. L. Ryvarden (URM 87642); Pernambuco, Jaqueira, RPPN Frei Caneca, Mata Guaribas, in litter, 9 Mar 2013, leg. G. S. Nogueira-Melo NM506, det. L. Ryvarden (URM 86408); Pernambuco, Jaqueira, RPPN Frei Caneca, Mata Barragem das Moças, in decaying hard wood, 20 Apr 2013, leg. G. S. Nogueira-Melo NM630, det. L. Ryvarden (URM 86409); Pernambuco, Recife: Parque

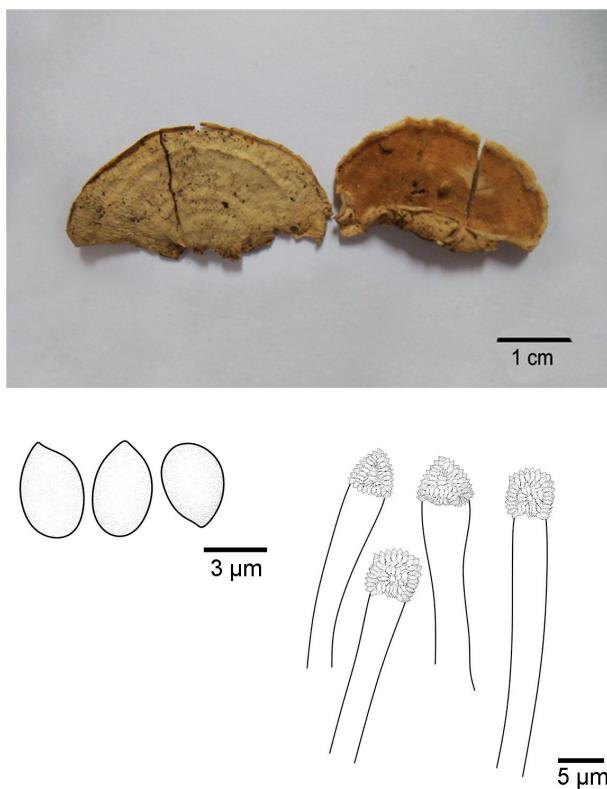


Figure 1. A. Basidiomata of *Junghuhnia semisupiniformis*. B. Encrusted tips of cystidia. C. Basidiospores

Estadual Dois Irmãos, in decaying hardwood, 18 May 2013, leg. R. Chikowski RC001, det. T. B. Gibertoni (URM 87694).

Remarks: This species is easily recognized because of the citric yellow basidiomata becoming reddish when bruised in fresh conditions (Westphalen *et al.* 2012).

Junghuhnia nitida (Pers.) Ryvarden, Persoonia 7(1): 18 (1972) = *Poria nitida* Pers., Observ. mycol. (Lipsiae) 2: 15 (1800) [1799]

Description: Ryvarden (2014)

Distribution: Cosmopolitan species (Ryvarden & Melo 2014). In Brazil, reports are known for the states of Alagoas, São Paulo and Rio Grande do Sul (Gugliotta *et al.* 2015). This is the first time the species has been found in the state of Pernambuco.

Material examined: BRAZIL. PERNAMBUCO: Jaqueira, Reserva de Patrimônio Natural Frei Caneca, Mata Barragem das Moças, 26.VII.2012, leg. G.S. Nogueira-Melo *et al.* NM271, det. L. Ryvarden (URM 86410); Ibid, IX.2013, leg. G.S. Nogueira-Melo *et al.* NM333, det. L. Ryvarden (URM 86524); Recife, Parque Estadual Dois Irmãos, Açude do Prata, s.d., leg. T.B.S. Gibertoni, det. L. Ryvarden (URM 76811); Ibid, s.d. leg. T.B.S. Gibertoni, det. L. Ryvarden (URM 76812).

Remarks: The diagnostic characters of *J. nitida* are the pinkish cinnamon pore surface, the abundant encrusted, thick-walled cystidia, and the ovoid to broadly ellipsoid basidiospores ($4-4.5 \times 2-2.5 \mu\text{m}$) (Ryvarden & Melo, 2014; Westphalen *et al.* 2012).

Key to the species of *Junghuhnia* recorded in Brazil

1. Basidiomata pileate sessile to effused-reflexed 2
- 1'. Basidiomata ressupinate to effused-reflexed 4
2. Pileus dimidiate to almost laterally stipitate *J. undigera*
- 2'. Pileus spatulate to fan shaped 3
3. Basidiospores ellipsoid to subglobose, $2.5-3 \times 2-2.5 \mu\text{m}$ *J. minuta*
- 3'. Basidiospores ellipsoid to obovoid, $3.5-4.5 \times 3-3.5 \mu\text{m}$ *J. semisupiniformis*
4. Basidiomata pinkish, yellow or red 5
- 4'. Basidiomata white to cream or pale brown 8
5. Pores round *J. meridionalis*
- 5'. Pores angular 6
6. Hymenial surface chrome yellow when fresh, becoming reddish when bruised *J. carneola*
- 6'. Hymenial surface ochraceous buff or pale buff to pinkish buff or pinkish cinnamon 7
7. Pores 2-5/mm *J. lacera*
- 7'. Pores 5-7/mm *J. nitida*
8. Hymenophore dentate to hydnoid *J. crustacea*
- 8'. Hymenophore poroid 9
9. Pores minute, invisible to naked eye, 7-9/mm *J. subundata*
- 9'. Pores larger, 4-7/mm 10
10. Basidiospores globose *J. globospora*
- 10'. Basidiospores cylindrical to ellipsoid 11
11. Basidiospores cylindrical, $4-5 \times 1.5-2 \mu\text{m}$ *J. luteoalba*
- 11'. Basidiospores ellipsoid to subcylindrical, $2.5-3.5 \times 1.0-1.5 \mu\text{m}$ *J. polycystidifera*

Junghuhnia subundata (Murrill) Ryvarden, Synop.
Fungorum 32: 61 (2014)
≡ *Poria subundata* Murrill, Mycologia 13(2): 86 (1921).

Description: Ryvarden (2014)

Distribution: Pantropical. Neotropical specimens have been seen from Puerto Rico, Costa Rica and Panama (Ryvarden 2014) and, in Brazil, reported in the State of Amapá (Soares *et al.* 2014a) and now from Amazonas. Other reports of *J. subundata* in Brazil were considered as dubious by Westphalen *et al.* (2012).

Material examined: BRAZIL, Amazonas, Humaitá, Floresta Nacional de Humaitá, in decaying hardwood, 23 Apr 2013, leg. A. Gomes-Silva AC167, det. L. Ryvarden (URM 87641).

Remarks: *Junghuhnia subundata* is mainly characterized by the tiny pores (7-9 per mm) and minute, subglobose to broadly ellipsoid basidiospores (2.5-3 × 2.5-4 µm). The size of the basidiospores separates it from the other resupinate species described in the genus. The occurrence of cystidia is apparently variable: sometimes, they are easily observed, while in other specimens they are difficult to find (Ryvarden 2014).

Acknowledgments

We thank the managers and staff of RPPN Frei Caneca for support during the field trips; Michael Finnie and Miles Hudson for English improvements; Dr. Roger Melo, for help with figures; the Programa de Pós-Graduação em Biologia de Fungos (UFPE, Brazil) and Conselho Nacional de Desenvolvimento Científico (CNPq) [SISBIOTA (563342/2010-2), PPBio Semi-Árido (457476/2012-5), PROTAX (562106/2010-3), Universal (472792/2011-3)] for financial support, and to Coordenação de Aperfeiçoamento de Pesquisa e Ensino Superior (CAPES) for the scholarship of GSNM and CRSL.

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