Rodriguésia 72: e01262019. 2021
http://rodriguesia.jbrj.gov.br
DOI: http://dx.doi.org/10.1590/2175-7860202172005

Short Communication

First occurrence of *Backusella gigacellularis* (Mucorales, Mucoromycota) in a fragment of an Upland Forest within the semi-arid region of northeastern Brazil

Ana Lúcia Sabino de Melo Alves[1,3], *Leslie Warren Silva de Freitas*[1,4], *Luciana Melo Sartori Gurgel*[2], *Joana D'Arc Alves Leitão*[1,5], *Thalline Rafhaella Leite Cordeiro*[1,6] & *André Luiz Cabral Monteiro de Azevedo Santiago*[1,7,8]

Abstract

In a survey mucoralean fungi in the Brejo da Serra do Benedito, a fragment of Upland Forest in the semi-arid region of Pernambuco, Brazil, a specimen of *Backusella gigacellularis* was isolated. So far, *B. gigacellularis* (holotype) had only been isolated from soil in the Cerrado domain, in São Paulo state, southeastern Brazil. This is the second report of *B. gigacellularis* worldwide, and the first record to northeastern Brazil. A detailed description, as well as the illustration of the specimen, are presented.

Key words: Mucoromyceta, soil, taxonomy, zygosporic fungi.

Resumo

Em um levantamento de espécies de fungos Mucorales no Brejo da Serra do Benedito, um Brejo de altitude do semi-árido pernambucano, Brasil, um espécime de *Backusella gigacellularis* foi isolado. Até o momento, *B. gigacellularis* (holótipo) só havia sido isolada de solo no Domínio Cerrado, no estado de São Paulo, sudeste do Brasil. Este é segundo registro mundial de *B. gigacellularis* e o primeiro para o nordeste do Brasil, especificamente em um a área de Brejo de altitude. Nesse trabalho, são apresentadas uma descrição detalhada e ilustração do espécime isolado.

Palavras-chave: Mucoromycota, solo, taxonomia, Fungos zigospóricos.

The Brazilian semi-arid region, characterized by high average temperatures, scarce precipitation, and soil with low productivity potential (Giulietti *et al*. 2006), predominantly supports typical vegetation of the caatinga domain, which tolerates and is adapted to semi-arid climatic conditions. The Upland Forest areas are enclaves of humidForest surrounded by vegetation of Caatinga, forming "islands" of rainforest in the middle of the semi-arid region that present different climatic conditions in relation to humidity, temperature and vegetation in comparison with areas of Caatinga (Tabarelli & Santos 2004).

Considering the elevated diversity and endemism of plants in the Atlantic Forest domain, it is probable that the current knowledge of diversity of mucoralean species in soils of the Upland Forest areas is insufficient (Lima *et al*.

[1] Federal University of Pernambuco, Department of Mycology, Postgraduate Program in Biology of Fungi, Recife, PE, Brazil.
[2] Agronomic Institute of Pernambuco, Recife, PE, Brazil. ORCID: <https://orcid.org/0000-0002-7431-2889>.
[3] ORCID: <https://orcid.org/0000-0002-9860-3963>.
[4] ORCID: <https://orcid.org/0000-0001-8903-4319>.
[5] ORCID: <https://orcid.org/0000-0002-0631-1462>.
[6] ORCID: <https://orcid.org/0000-0002-3430-5852>.
[7] ORCID: <https://orcid.org/0000-0001-5174-5553>.
[8] Author for correspondence: andrelcabral@msn.com

2018a). So far, 34 species of Mucorales have been reported for the Brazilian Upland Forest areas, including six recently described new species (Hyde *et al*. 2016; Tibpromma *et al*. 2017; Lima *et al*. 2018b) and two first occurrences for Brazil (Santiago & Maia 2010; Alves *et al*. 2017).

The genus *Backusella*, described by Ellis & Hesseltine (1969), was created to accommodate species that produce terminal multispored sporangia as well as uni- and/or multispored sporangiola that arise laterally from sporangiophores (Benny 2005). *Backusella* specimens are commonly isolated from soil and rodent dung (Benny & Benjamin (1975). This genus underwent modifications by Benny & Benjamin (1975), who have proposed *B. lamprospora* (≡ *Mucor lamprosporus* Lendn.) and *B. ctenidia* (≡ *Thamnidium ctenidium* Durrell & M. fkeming). Walther *et al*. (2013), in a review using ITS and LSU sequences of rDNA, proposed more significant changes, with the transference of all species of *Mucor* Fresen. with transiently recurved sporangiophores when young to *Backusella*. Currently, this genus comprises fifteen species: *B. azygospora* T.R.L. Cordeiro, Hyang B. Lee & A.L. Santiago, *B. constricta* D.X. Lima, C.A.F. de Souza & A.L. Santiago, *B. circina* J.J. Ellis & Hesselt., *B. gigacellularis* J.I. de Souza, Pires-Zottarelli & Harakava, *B. grandis* (Schipper & Samson) Walther & de Hoog, *B. granulispora* L.S. Loh & Kuthub, *B. indica* (Baijal & B.S. Mehrotra) Walther & de Hoog, *B. johorensis* L.S. Loh, Nawawi & Kuthub, *B. lamprospora* (Lendn.) Benny & R.K. Benj., *B. locustae* Hyang B. Lee, S.H. Lee & T.T.T Nguyen, *B. oblongielliptica* (H. Nagan., Hirahara & Seshita *ex* Pidopl. & Milko) Walther & de Hoog, *B. oblongispora* (Naumov) Walther & de Hoog, *B. recurva* (E.E. Butler) Walther & de Hoog, *B. tuberculispora* (Schipper) Walther & de Hoog, *B. variabilis* (A.K. Sarbhoy) Walther & de Hoog. For Brazil, *B. azygospora*, *B. lamprospora*, *B. gigacellularis* and *B. constricta* have been recorded.

During a survey of Mucorales species in soils of an Upland Forest area located in the semiarid region of Pernambuco, *B. gigacellularis* was isolated and is being reported for the first time from northeastern Brazil. This species had previously only been isolated in the Cerrado biome in São Paulo state, Brazil (de Souza *et al*. 2014).

For isolation, five milligrams of soil were added to wheat germ agar culture medium (Benny 2008) amended with chloramphenicol (80 mg.L^{-1}) in Petri dishes in triplicate. The growth of colonies was monitored for 96 hours at room temperature (28 ± 2 °C). In order to purify the Mucorales, fragments of the colonies were transferred separately to MEA (malt extract agar medium) (Benny 2008) plus chloramphenicol (80 mg.L^{-1}). The specimen was identified through observation of macroscopic (color, appearance, and diameter of the colony) and microscopic (shape and size of sporangiophores, columellae, sporangia, sporangiospores, and giant cells) characteristics based on the description of de Souza *et al*. (2014).

Backusella gigacellularis J.I. de Souza, Pires-Zottarelli & Harakava, Mycol. Progr. 13: 976 (2015). Fig. 1

Colony white-yellowish, reverse yellow, colonizing the entire Petri dish (9 cm diam. and 1.5 cm high) in 5 days, at 25 °C, in MEA. Sporangiophores hyaline, some with greenish-brown contents, arising from the substrate, recurved when young and becoming erect when mature, up to 20 µm in diam, monopodially branched, mostly with short branches and slightly encrusted wall. Sporangia globose, with smooth and deliquescent wall, up to 130 µm in diam. Columellae globose, subglobose, conical and slightly cylindrical, 20–40 (–50) × 20–45 µm, hyaline, with slightly encrusted wall, some with brown contents; collar commonly present with needle-shaped spines. Multispored sporangiola arising from pedicels, hyaline, with equinulated wall, globose to subglobose 9.5–28 µm in diam. Unispored sporangiola absent. Columellae of sporangiola conical and occasionally globose, hyaline, 7–12(–14) × 15–30 µm. Sporangiospores hyaline, smooth-walled, ellipsoid, irregular, a few subglobose (9–)16–33(–45) × (7–)9–17(–20) µm, with oil droplets. Giant cells, globose. Zygospores not observed.

Material examined: BRAZIL. PERNAMBUCO: Gravatá, Serra do Benedito (08°17'58''S, 35°35'29''W), soil, *A.L.S.M. Alves* (URM 7894).

The species occurs in São Paulo and Pernambuco states, Brazil. This is the second report worldwide and the first report of this species in northeastern Brazil.

Minor morphological differences were observed between *B. gigacellularis* URM 7894 and the holotype described by de Souza *et al*. (2014). Sporangiophores up to 20 µm diam. were found in *B. gigacellularis* URM 7894, slightly larger than those described by de Souza *et al*. (2014), which are up to 16.8 µm. We also observed globose,

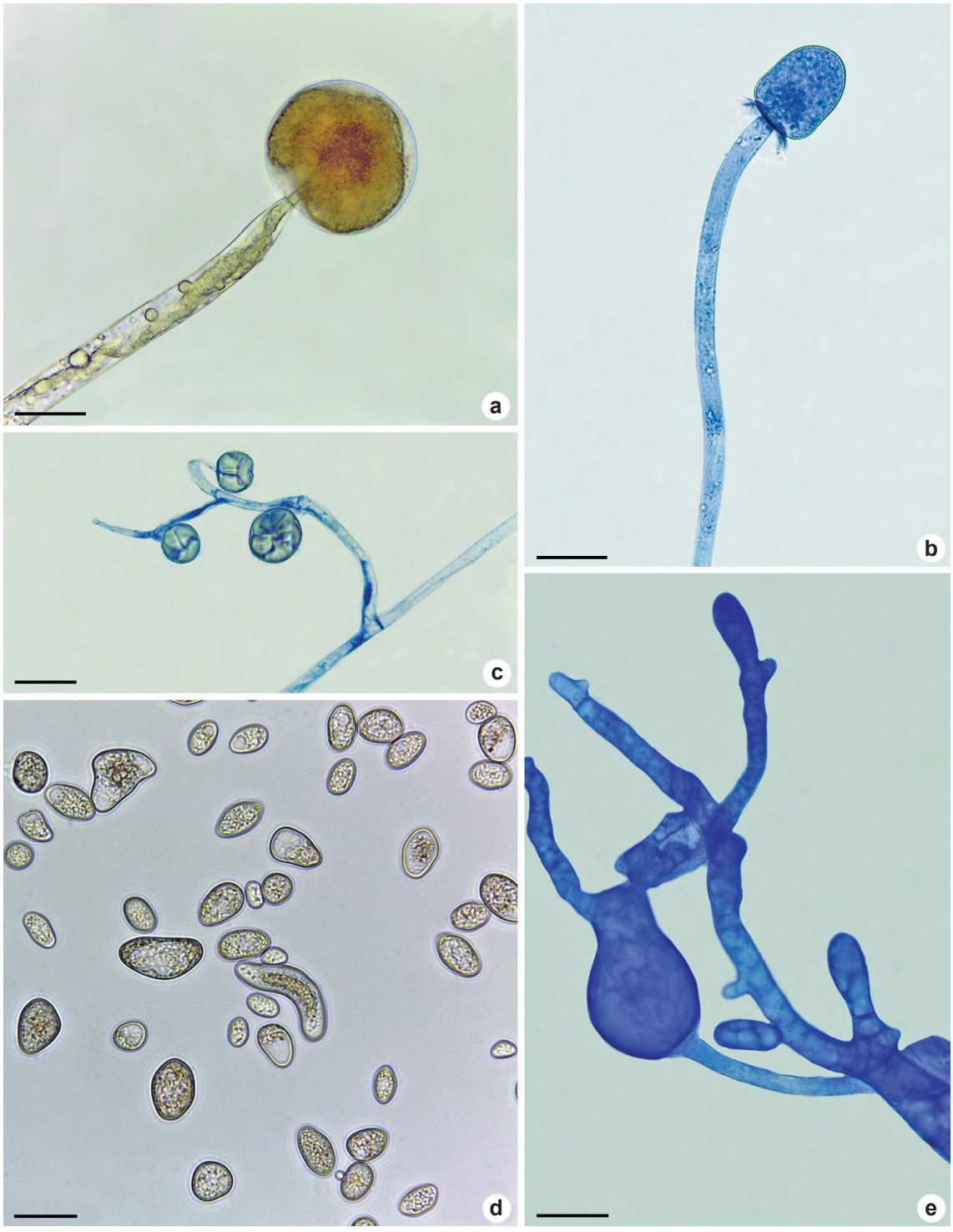

Figure 1 – a-e. *Backusella gigacellularis* (URM 7894) – a. unbranched sporangiophore with sporangium; b. unbranched sporangiophore with columella; c. sympodially branched sporophore bearing only sporangiola; d. sporangiospores; e. giant cell. Bars: a, b, c, d, e = 25 µm.

subglobose, conical and slightly cylindrical columellae, 20–40(–50) × 20–45 µm, whereas de Souza *et al*. (2014) reported ellipsoid, cylindrical and rarely pyriform columellae, 9.4–53 × 8.2–46 µm. Sporangiola of *B. gigacellularis* URM 7894 were larger (up to 28 µm in diam) than the holotype sporangiola that were up to 23 µm in diam.

This work increases the knowledge of the *Backusella* genus in Brazil, especially in Upland Forest areas that are being severely degraded by anthropic influences.

Acknowledgemets

This manuscript was financed by the Project "Diversity of Mucoromycotina in the different ecosystems of the Atlantic Rainforest of Pernambuco" (FACEPE - First Projects Program PPP/FACEPE/CNPq - APQ - 0842-2.12/14). The authors also thank the Conselho Nacional de Desenvolvimento Científico e Tecnológico, for the scholarship awarded to André L.C.M.A. Santiago, and the Coordenacão de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), for the scholarships provided to Ana L.S.M. Alves, Thalline R.L. Cordeiro, Joana D'Árc A. Leitão, and Leslie W.S. de Freitas.

References

Alves ALSM, Souza CAF, Oliveira RJV, Cordeiro TRL & Santiago ALCMA (2017) *Cunninghamella clavata* from Brazil: a new record for the western hemisphere. Mycotaxon 132: 381-389.

Benny GL (2005) *Zygomycetes*. Available at <http://www.zygomycetes.org>. Access on 24 May 2019.

Benny GL (2008) The methods used by Dr. R.K. Benjamin, and other mycologists to isolate Zygomycetes. Aliso 26: 37-61.

Benny GL & Benjamin RK (1975) Observations on Thamnidiaceae (Mucorales). New taxa, new combinations, and notes on selected species. Aliso 8: 301-351.

De Souza JI, Marano AV, Pires-Zottarelli CLA, Chambergo FS & Harakava R (2014). A new species of *Backusella* (Mucorales) from a Cerrado reserve in Southeast Brazil. Mycological progress 13: 975-980.

Ellis EC, Fuller DQ, Kaplan JO & Lutters WG (2013) Dating the Anthropocene: towards an empirical global history of human transformation of the terrestrial biosphere. Proceedings of the National Academy of Sciences 110: 7978-7985.

Ellis JJ & Hesseltine LW (1969) A new member of the Mucorales. Mycologia 61: 863-872.

Giulietti AM, Conceicao A & Queiroz LP (2006) Diversidade e caracterização das fanerógamas do semi-árido brasileiro. Associacão Plantas do Nordeste, Recife. 488p.

Hyde KD, Hongsanan S, Jeewon R, Bhat JD, McKenzie EH, Jones EBG, Phookamsa R, Ariyawansa AH, Boonmee S, Zhao Q, Abdel-Aziz FA, Abdel-Waha MA, Banmai S, Chomnunti P, Cui B, Daranagama DA, Das K, Dayarathn MC, Silva NI, Dissanayake AJ, Doilom M, Ekanayaka AH, Gibertoni TB, Go'es-Neto A, Huang S, Jayasiri SC, Jayawardena RS, Konta S, Lee HB, Li W, Lin C, Liu J, Lu Y, Luo Z, Manawasinghe IS, Manimohan P, Mapook A, Niskanen T, Norphanphoun C, Papizadeh M, Perera RH, Phukhamsakda C, Richter CC, Santiago ALCMA, Drechsler-Santos ER, Senanayake IC & Tanaka K (2016) Fungal diversity notes 367-490: taxonomic and phylogenetic contributions to fungal taxa. Fungal Diversity 80: 1-270.

Lima DX, Cordeiro TFL, Souza CAF, Santiago ALCMA & Souza-Motta CM (2018a) Diversity of basal fungal order Mucorales (Mucoromycota) in a remaining area of the Brazilian Atlantic Rainforest. Nova Hedwigia 107: 459-471.

Lima CLF, Lima DX, Souza CAF, Oliveira RJV, Cavalcanti IB, Gurgel LMS & Santiago ALCMA (2018b) Description of *Mucor pernambucoensis* (Mucorales, Mucoromycota), a new species isolated from the Brazilian Upland Rainforest. Phytotaxa 350: 274-282.

Santiago ALCMA & Maia LC (2010) Two new records of Mucorales from the Brazilian semi-arid region. Mycotaxon 114: 17-20.

Tabarelli M & Santos AMM (2004) Uma breve descrição sobre a história natural dos Brejos nordestinos. *In*: Porto KC, Cabral JJP & Tabarelli M (eds.) Brejos de altitude em Pernambuco e Paraíba - História Natural, Ecologia e Conservação. Ministério do Meio Ambiente, Brasilia. Pp. 17-24.

Tibpromma S, Hyde KD, Jeewon R, Maharachchikumbura SSN, Liu JK, Bhat DJ, Jones EBG, McKenzie EHC, Camporesi E, Tibpromma TS, Jeewon R, Bulgakov TS, Doilom M, Santiago ALCMA, Das K, Manimohan P, Gibertoni TB, Lim YW, Ekanayaka AH, Thongbai B, Lee HB, Yang JB, Kirk PM, Sysouphanthong P, Singh SK, Boonmee S, Dong W, Anil Raj KN, Latha KPD, Phookamsak R, Phukhamsakda C, Konta S, Jayasiri SC, Norphanphoun C, Tennakoon DS, Li J, Dayarathne MC, Perera RH, Xiao Y, Wanasinghe DN, Senanayake IC, Goonasekara ID, Silva NI, Mapook A, Jayawardena RS, Dissanayake AJ, Manawasinghe IS, Chethana KWT, Luo ZL, Hapuarachchi KK, Baghela A, Soares AM, Vizzini A, Meiras-Ottoni A, Mešić A, Dutta AK, Souza CAF, Richter C, Lin CG, Chakrabarty D, Daranagama DA, Lima DX, Chakraborty D, Ercole E, Wu F, Simonini G, Vasquez G, da Silva GA, Plautz Jr. HL, Ariyawansa HA, Lee H, 30, Kušan I, Song J, Sun J, Karmakar J, Hu K,

Semwal KC, Thambugala KM, Voigt K, Acharya K, Rajeshkumar KC, Ryvarden L, Jadan M, Hosen MI, Mikšík M, Samarakoon MC, Wijayawardene NN, Kim NK, Matočec N, Singh PN, Tian Q, Bhatt RP, de Oliveira RJV, Tulloss RE, Aamir S, Kaewchai S, Marathe SD, Khan S, Hongsanan S, Adhikari S, Mehmood T, Bandyopadhyay TK, Svetasheva TY, Nguyen TTT, Vladimır A, Li W-J, Wang Y, Indoliya Y, Tkalčec Z, Elgorban AM, Bahkali AH, Tang AMC, Su H-Y, Zhang H, Promputtha I, Luangsa-ard J, Xu J, Yan J, Ji-Chuan K, Stadler M, Mortimer PE, Chomnunti P, Zhao Q, Phillips AJL, Nontachaiyapoom S, Wen T-C, Karunarathna SC (2017) Fungal diversity notes 491-602: taxonomic and phylogenetic contributions to fungal taxa. Fungal Diversity 83: 1-261.

Walther G, Pawłowska J, Alastruey-Izquierdo A, Wrzosek M, Rodriguez-Tudela JL, Dolatabadi S, Chakrabarti A & Hoog GS (2013) DNA barcoding in Mucorales: an inventory of biodiversity. Persoonia 30: 11-47.

Area Editor: Dr. Anibal de Carvalho Junior
Received in July 12, 2019. Accepted in September 27, 2019.