First report of *Laternea dringii*, Phallales (Agaricomycetes) in the Central-West, State of Goiás, Brazil

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Abstract

Laternea dringii, a species of the phylum Basidiomycota, is notable for its distribution in tropical and neotropical regions. This study, conducted in the Cerrado area of Central-West Brazil, State of Goiás, reports the first record of *L. dringii* in this region. The study site, a farm with over 90 years of agricultural production, features moist soils rich in organic matter. In January 2024, specimens of *L. dringii* were collected, photographed, and identified using microscopic data and a key for the genus Laternea. This finding represents a significant expansion in the known distribution of *L. dringii*, previously documented only in Mexico and some Brazilian states. The discovery underscores the mycological diversity of the Brazilian Cerrado and contributes to a better understanding of the geographical distribution of fungi from the phylum Basidiomycota in Brazil.

Keywords: biodiversity, gasteromycetes, *Laternea*, micology, taxonomy, *Phallales.*

Primeiro relato de *Laternea dringii*, Phallales (Agaricomycetes) no Centro-Oeste, Estado de Goiás, Brasil

Resumo

Laternea dringii, uma espécie do filo Basidiomycota, destaca-se por sua distribuição em regiões tropicais e neotropicais. Este estudo, realizado na área do Cerrado no Centro-Oeste brasileiro, Estado de Goiás, reporta o primeiro registro de *L. dringii* nesta região. O local de estudo, uma fazenda com mais de 90 anos de produção agrícola, apresenta solos úmidos ricos em matéria orgânica. Em janeiro de 2024, foram coletados exemplares de *L. dringii*, os quais foram fotografados e identificados usando dados microscópicos e uma chave de identificação para o gênero *Laternea*. Este achado representa uma expansão significativa na distribuição conhecida de *L. dringii*, que anteriormente era documentada apenas no México e em alguns estados brasileiros. A descoberta reforça a diversidade micológica do Cerrado brasileiro e contribui para um melhor entendimento da distribuição geográfica dos fungos do filo Basidiomycota no Brasil.

Palavras-chave: biodiversidade, gasteromycetes, *Laternea*, micologia, taxonomia, *Phallales*.

1. Introduction

The tropics are considered the center of mycological biodiversity in the world, where Central and South America are considered breeding grounds for various fungal groups according to Hosaka (2012). In these environments there is a great diversity of Agaricomycetes of the order *Phallales* that inhabit different types of humid soils, rich in organic matter in dense litter (Dring, 1980).

The order *Phallales* E. Fisch is well defined within Phallomycetidae (Hosaka et al., 2006; Hibbett et al., 2014; Lima et al., 2019) where it was initially described to include Clathraceae with nine genera and Phallaceae with

seven genera per Fischer (1887) and described by Magnago et al. (2013). In 1931(a,b) researcher Cunningham added the monogeneric *Claustulaceae* (Claustula K. M. Curtis) to the order. In subsequent studies using phylogenetic analysis using molecular data, Hosaka et al. (2006) divided the order into six families (Clathraceae, Claustulaceae, Lysuriaceae, Protophallaceae, Trappeaceae and Phallaceae), the latter of which includes the genus *Laternea*, especially the specimen *Laternea dringii*.

The species included in *Plallales* have expanded basidiomas known as Stinkhorns that can be free, lattice or sequestered such as *Claustula* K. M. Curtis, *Gele pellis* Zeller, *Protubera* Möller and *Restingomyces* Sulzbacher, Grebenc & Baseia (Sulzbacher et al., 2016), with bright colors which are morphologically unusual and often have an unpleasant odor, also presenting varieties in their patterns. However, this foul odor may or may not be present in the species. López et al. (1981) in the first study and description of *L. dringii* do not discuss this presence of a strong odor, the same is observed in the study by Lima *et al*. (2019) for this species where researchers do not report the presence of odors in their description. Although, in the study by Magnago et al. (2013) where they describe the first report in Brazil of *L. dringii*, the researchers report a strong odor, the same was described in our finding for the first report of *L. dringii* in the Center-West of Brazil. This unpleasant odor is linked to entomocoria. The dispersion of basidiospores generally occurs by mycophagous animals, especially flies that are attracted by the odor of the mature gleba (Tuno, 1998).

In Brazil *Phallales sensu* was first described by Hosaka et al. (2006) discussed the presence of fourteen genera and approximately 33 species (Trierveiler-Pereira; Baseia, 2009, Trierveiler-Pereira et al., 2009; Ottoni et al., 2010; Fazolino et al., 2010, Cortez et al., 2011a), however, later studies by Cortez et al. (2011a,b) describe approximately 51 taxa of phalloid fungi. However, some of these records are considered synonymous or dubious records because the proof of the specimens were not well preserved. The various finds are described for the Atlantic Forest and also several species reported in the Brazilian Pampa Biome area (Braun, 1932; Rick, 1961; Cortez et al., 2011a,b).

Thus, this study reporting the species *L. dringii* is about the contribution to increasing the fungal knowledge of gasteroids in the Brazilian Cerrado environment and increasing the Mycological fauna of the State of Goiás, Brazil. In this study, we describe the first report of *Laternea dringii* in the Central-West, State of Goiás, Brazil.

2. Materials and Methods

2.1 Registration area

The study area, georeferenced with the coordinates 14°56'52.5"S and 49°36'23.6"W, is a remnant of the Cerrado biome in its restricted sense. Currently, it is under substantial anthropogenic influence due to over 90 years of rural production. This area is located on the Mirante Farm, a Rural Unit owned by Solimar de Fátima Teixeira Rezende, in the municipality of Itapaci, Goiás State, Brazil. It was mapped using a Global Positioning System (GPS) and analyzed with Idrisi Software, revealing an extent of 20 m² at an altitude of 550 meters.

2.2 Description of the area and classification of the specimen

The collection was conducted on January 07, 2024. During this period, the basidiomata were photographed. Specimens of *L. dringii* were transported to the Technological Chemistry Laboratory at the Agrochemistry Department of the Goiano Federal Institute, located in Rio Verde, Goiás State, Brazil. The first author of this study carried out the identification. Two samples of basidiomas, representing both a mature and an immature stage, were preserved in an ultrafreezer for further analysis and future research. These samples were cataloged with the voucher ANFI 10. The identification process involved the use of microscopic data and the identification key for *Laternea*, as described by López et al. (1981).

3. Results and Discussion

The specimens of *L. dringii* described in this study were between 1 - 1.5 cm in size. López et al. (1981) describes the fruiting body measuring 1.3-1.5 cm in height, growing in tropical soil (gregarious, in groups of up to 22 fruiting bodies, on soil with organic matter in disturbed evergreen tropical forest, in the shade of herbs and shrubs) in the State of Veracruz, Mexico. Magnago et al. (2013) described this species for the first time in the Atlantic Forest, State of Paraíba, Brazil with a size of 1 cm for individuals of *L. dringii*. Another description for *L. dringii* was carried out in the State of Ceará, Brazil by Lima et al. (2019) which comprises the Caatinga Biome.

Laternea dringii A. López, Martínez, D., & García, J. Bol. Soc. Mex. Micol., 16: 110, 1981 descriptors of this

species in forests of Veracruz in Mexico present the following description.

Unexpanded basidiome not observed. Expanded basidiome epigeous, 1.5 cm high x 1.0 cm in diam., consisting of four vertical columns fused at the apex and forming a transversal arm, vertical columns 0.15 - 0.3 cm in diam., tapering toward their apices, free at the base, each furnished with internal longitudinal furrows, orange. Volva 0.7 - 1.0 cm, sacculiform, white, with whitish rhizomorphs attached at the base. Gleba confined to an internal, apical glebifer, glebifer approximately 0.25 cm in diam., glebal mass olivaceous, odor not recorded.

Our specimen of *L. dringii* was found growing on earthy soil where pasture grows. In our finding, the fruiting body of *L. dringii* had a strong odor. Magnago et al. (2013) describes for the first time *L. dringii* in Brazil growing in sandy soil among leaf litter.

Characteristics: *Laternea dringii* is characterized by small-sized basidiomata (1.3 - 1.5 cm), yellowish to light orange columns and apical, solitary glebifer. Basidiospores were seen and, according to López et al. (1981), they are bacilloid, smooth, hyaline to greenish, 4.2 - 5.0 (- 5.6) x 1.4 mm; spores with 4.2 - 5 (- 5.6) x 1.4 microns; orange-red color with yellow at the base. *Laternea triscapa* is a similar species with basidiomata that are larger (4 - 7 cm high), vertical columns that are reddish to pinkish and trapezoid in cross section, and lacks a transversal column (López et al., 1981). *Laternea dringii* was considered a synonym of *L. triscapa* by Calonge et al. (2004) (misidentified) but diagnostic features of the species presented by López et al. (1981) seem to be enough to separate it.

Key to the *Phallales* from the tropical region of the Atlantic Forest (Magnago et al., 2013) and Cerrado Domain (2024) in this study.

1. Mature basidiome globose to subglobose, not forming expanded pseudostipe or receptaculum…….**2**

1’. Mature basidiome with pseudostipe simple, ramified into arms, columns, or clathroid receptaculum…..…...**3**

2. Basidiome hypogeous to subhypogeous, in longitudinal section it is possible to observe a thick gelatinous matrix below the peridium, glebal mass globose surrounding a central columella, gleba not connected to the peridium……...…….***Gelopellis thaxteri***

2’. Basidiome epigeous, in longitudinal section it is possible to observed elongated elliptical glebal plates immersed in a gelatinous matrix, columella absent, gleba plates connected to the inner part of the peridium by sutures……..……..***Protubera maracuja***

3. Basidiome with single pseudostipe……...**4**

3’. Basidiome with pseudostipe ramified into arms, columns, or clathroid receptaculum……..…...……..**10**

4. Receptaculum applanate, sunflower-shaped, gleba covering a central perforate disc..….***Abrachium floriforme***

4’. Receptaculum not applanate, gleba at the tip of the receptaculum or forming a ring……..…….**5**

5. Pseudostipe perforated, constricted by a ring at the upper part, glebal mass covering the ring……...……...***Staheliomyces cinctus***

5’. Pseudostipe not perforated, constricted ring region absent…….……..**6**

6. Glebal mass covering the apex of the pseudostipe, receptaculum absent…….**7**

6’. Glebal mass covering a campanulate receptaculum located at the apex of the stipe……..…...**8**

7. Pseudostipe up to 8.2 cm high, whitish, glebal zone covering almost ½ of the pseudostipe.***Mutinus argentinus***

7’. Pseudostipe up to 5.5 cm high, pinkish, glebal zone covering about 1/3 of the pseudostipe……..***Mutinus caninus***

8. Basidiome minute, up to 1.5 cm high, growing on dead wood……...…….***Xylophallus xylogenus***

8’. Basidiome larger, 10 - 18 cm high, growing on soil……..……**9**

9. Pseudostipe whitish, receptaculum surface reticulate, long indusium present…….***Phallus indusiatus***

9’. Pseudostipe orange to reddish, receptaculum finely rugulose, indusium absent……..…***Phallus rubicundus***

10. Pseudostipe yellowish to reddish, ramified into 2 - 5 columns or arms……...….**11**

10’. Pseudostipe whitish, ramified into a clathroid receptaculum, forming more or less polygonal meshes…….**13**

11. Glebal mass spread in the internal portion in the apex of the columns……..***Clathrus columnatus***

11’. Gleba confined into an apical glebifer……..…….**12**

12. Basidiome 1.3 - 1.5 cm high, columns yellowish to light orange, transversal column present.***Laternea dringii***

12’. Basidiome 4 - 7 cm high, columns reddish to pinkish, transversal column absent…….....***Laternea triscapa***

13. Arms fused and forming a pseudostipe at the base, glebal mass confined into glebifers which are located at the arms connections……...……..…….***Clathrus chrysomycelinus***

13’. Arms not forming a pseudostipe at the base, glebal mass spread in the inner surface of the arms……...……***Ileodictyon cibarium***

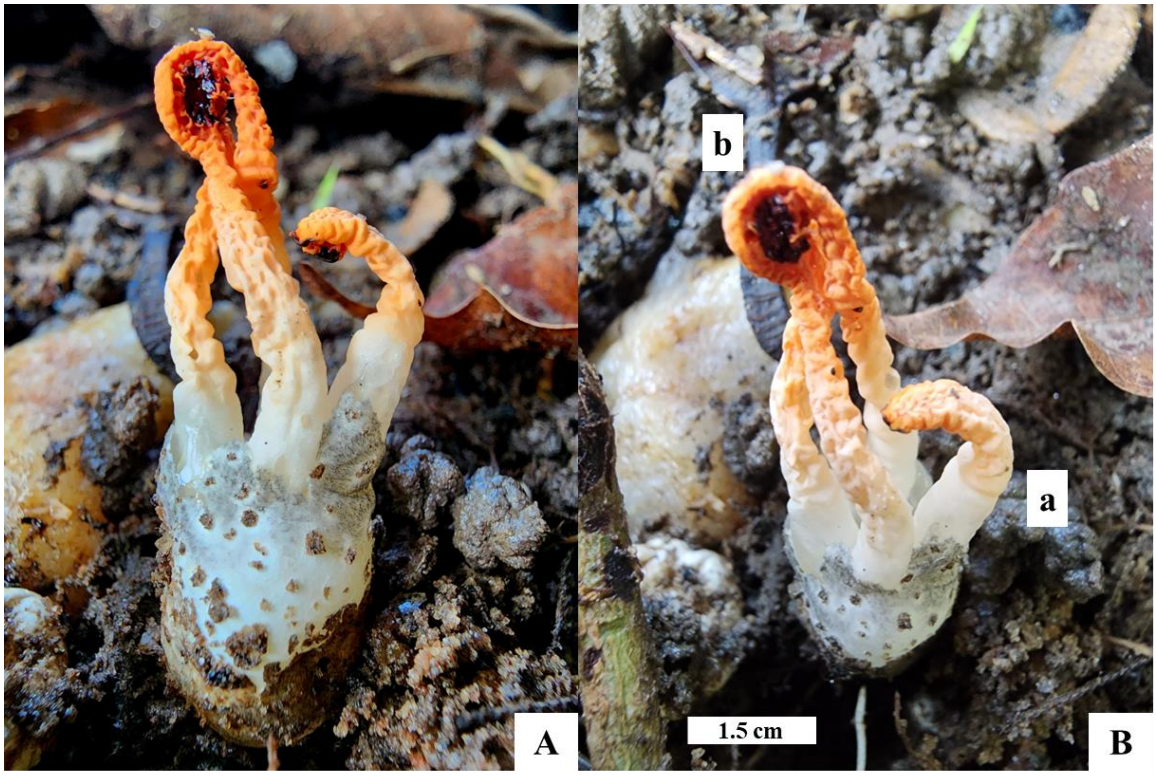

Figure 1. Specimen of *Laternea dringii* mushrooms (**A** and **B**). In (**B**) (**a**) tetracolumnar basidiocarp and in (**b**) glebiferous. Photographer: Machado, T. H. L., 2024.

4. Conclusions

The discovery of *L. dringii* in the Center-West region of Brazil marks a significant expansion of the known distribution range of this species. Previously, its presence was recorded solely in the State of Paraíba, Brazil, with its initial identification in the State of Veracruz, Mexico. This finding not only extends our understanding of the geographical reach of *L. dringii* but also underscores the ecological diversity and richness of the Center-West biome. It highlights the importance of ongoing research and exploration in these regions to uncover the full extent of biodiversity present, potentially leading to further revelations about species distribution and habitat preferences.

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6. Authors’ Contributions

Tullyo Henrique Lima Machado: collection, initial analysis of the species, identification of specimen, article writing, and translation. *Antonio Carlos Pereira de Menezes Filho*: article writing, translation and publication. *Matheus Vinícius Abadia Ventura*: identification key and complementary evaluation. *Aparecida Sofia Taques*:

identification key and complementary evaluation. *Tiago Carnevalle Romão*: identification key and complementary evaluation

7. Conflicts of Interest

No conflicts of interest.

8. Ethics Approval

Not applicable.

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