

First report of the saprotrophic mushroom *Amanita thiersii* Pers. (Amanitaceae, Basidiomycota) in the state of Goiás, Central-West Brazil

Leonardo Fleuri Alves¹, José Rodolfo Juvêncio Martins¹, Antonio Carlos Pereira de Menezes Filho², Tullyo Henrique Lima Machado³, Vanêcia Oliveira Cunha Machado⁴, Tiago Carnevalle Romão⁵ & Matheus Vinícius Abadia Ventura^{1,5}

¹ UniBRAS Rio Verde University Center, Goiás State, Brazil

² Menezes Agricultural Research, Rio Verde, Goiás State, Brazil

³ Goiano Federal Institute, Ceres, Goiás State, Brazil

⁴ Assumption School, Itapaci, Goiás State, Brazil

⁵ Goiano Federal Institute, Rio Verde, Goiás State, Brazil

Correspondence: Antonio Carlos Pereira de Menezes Filho, Menezes Agricultural Research, Rio Verde, Goiás State, Brazil. E-mail: astronomoamadorgoias@gmail.com

Received: October 12, 2024

DOI: 10.14295/bjs.v3i1.693

Accepted: October 31, 2024

URL: <https://doi.org/10.14295/bjs.v3i11.693>

Abstract

Amanita is a group of mushrooms of medical and culinary interest. *Amanita thiersii* is a species that has been little reported regarding its areas of occurrence. It is known that records of *A. thiersii* have been reported in Argentina, Mexico, and the United States. Our study reports the first record of *A. thiersii* in Brazilian territory. The specimen was collected in an area of the Cerrado domain, specifically in a Cerradão with mixed sandy-saprolitic soil. The identification of the mushroom *A. thiersii* was performed using an identification key for the genus *Amanita*. This is the first report of *Amanita thiersii* in Brazilian territory, collected in the Central-West region, state of Goiás.

Keywords: *Amanita* genus, ectomycorrhizal, Agaricales, mushrooms.

Primeiro relato do cogumelo sapotrófico *Amanita thiersii* Pers. (Amanitaceae, Basidiomycota) no estado de Goiás, Centro-Oeste do Brasil

Resumo

Amanita é um grupo de cogumelos de interesse médico e alimentício. *Amanita thiersii* é uma espécie pouco relatada quanto as suas áreas de encontros. Sabe-se que, registros para *A. thiersii* são relatados na Argentina, México e Estados Unidos. Nosso estudo relata o primeiro registro de *A. thiersii* em território brasileiro. O espécime foi coletado em área de Domínio Cerrado, tipo Cerradão com solo misto arenoso saprolítico. A identificação do cogumelo *A. thiersii* foi realizada utilizando chave de identificação para o gênero *Amanita*. Esse é o primeiro relato de *Amanita thiersii* em território brasileiro, coletado no Centro-Oeste, estado de Goiás.

Palavras-chave: gênero *Amanita*, ecotomicorrízico, Agaricales, cogumelos.

1. Introduction

The genus of mushrooms *Amanita* has approximately 1,000 described species worldwide (Tulloss, 2005). Most of the species included in *Amanita* form ectomycorrhizal associations with woody plants (Wolfe et al., 2012). Although fruiting bodies of approximately 15 *Amanita* species have been collected at significant distances from potential host species of woody plants, in natural or artificial pastures, they are thus classified as provisionally saprotrophic.

Within this large group of *Amanita*, *Amanita thiersii* is classified as saprotrophic within the symbiotic clade found in leaf litter in forests, grasslands, and anthropogenically modified areas (Cui et al., 2018; Dunkirk et al., 2023). The species *A. thiersii* was first described by Harry D. Thiers from College Station, Brazos County, Texas, U.S.A. in 1957 (using the invalid name *A. alba* Thiers; Thiers, 1957), and it was later validly named for Thiers (Bas, 1969). *A. thiersii* is reported to be abundant in the United States (Kuo; Methven, 2010), where it is likely native to North America. *A. thiersii* shares similarities with another white decomposer, the Argentine *Amanita foetens* (Singer, 1953), raising questions about whether they may be the same species.

Several species of *Amanita* deserve medical respect due to their toxicity; however, some are safe and used as food. The fungal genus *Amanita* is divided into seven sections (Tullo; Yang, 2011). Mushrooms belonging to the sections Caesareae (Caesar's Amanita: *Amanita caesaria*) and *Vaginatae* (grisette) are edible. Poisonous species can be found in all other sections of the genus. The death caps (*Amanita phalloides*, *Amanita virosa*; section Phalloideae) contain hepatotoxic cyclopeptides (amatoxins, phalloidin) and cause fulminant hepatic and renal failures that are, if at all, treatable only symptomatically (Diaz, 2005).

The section *Amanita* contains the quintessential toadstool *Amanita muscaria* (fly agaric). Toxic species of the section *Amanita* contain the neurotoxins ibotenic acid and muscimol. In the section *Validae*, slightly toxic mushrooms containing bufotenine and/or haemolytic toxins can be found (false death cap: *Amanita citrina* (Flammer; Horak, 2003)). In sections, *Lepidella* and *Amidella*, edible and nephrotoxic fungi are known. Among the genus *Amanita*, the North American *Lepidella amantia smithiana* (Leathem; Pursell, 1995; West et al., 2008) and the Mediterranean *Amidella amantia proxima* are repeatedly reported to be nephrotoxic (Crispula, 1985; Courtin et al., 2009). Renal failure has been reported for cases of poisoning with the mushrooms *A. thiersii* and *A. nauseosa* in North and Central America (both *Lepidella* sections) (Kirchmair et al., 2012). Patients received supportive treatment requiring temporary hemodialysis with a good prognosis for cure. As observed, *A. thiersii* is a toxic white mushroom from the *Amanita* group with recorded clinical cases (Kirchmair et al., 2012). Its presence in different environments where the species is not native underscores the importance of accurate identification so that the mycological flora of the regions is well understood, and timely medical assistance can be provided in case of accidental ingestion.

In Brazil, several species of *Amanita* are described, such as *A. aliena*, *A. amegninoidi*, *A. aureofloccosa*, *A. campinaeanae*, *A. chrysoleuca*, *A. coacta*, *A. craseoderma*, *A. crebresulcata*, *A. dulciodora*, *A. excelsa*, *A. grillipes*, *A. lanivolva*, *A. lilloi*, *A. lippiae*, *A. muscaria*, *A. pantherina*, *A. petalinovolva*, *A. phaea*, *A. psammolimbata*, *A. rubescens*, *A. strobiliformis*, *A. sulcatissima*, *A. tenacipulvis*, *A. viridissima*, *A. viscidolutea*, and *A. xerocybe* in various states of Brazil, such as Amazonas, Pernambuco, Rio Grande do Sul, Paraná, Bahia, Paraíba, Rondônia, São Paulo, Santa Catarina, and Rio Grande do Norte (Scheibler, 2019).

Understanding the fungal flora of regions, including South America, is crucial, especially given that the predominant tropical climate is a significant factor in developing various groups of mushrooms, both edible and toxic. In our study, we present the first record of *Amanita thiersii* in an area of the Cerrado Domain in the state of Goiás, Central-West Brazil.

2. Materials and Methods

2.1 Collection and Identification of the Specimen

The material was collected during field expeditions conducted between September and October 2024 in a predominantly conserved Cerrado area known as Cerradão, located in the municipality of Itapaci, Unidade Rural Fazenda Vinagre, in the state of Goiás, Brazil. The geographic coordinates are 14°53'16.4" S and 49°36'37.7" W. The collection was carried out by Biologist Master Tullyo Henrique Lima Machado and Specialist Vanêcia Oliveira Cunha Machado. The material was photographed in the field and described macromorphologically while still fresh. A key for identifying the *Amanita* genus was applied to the species *A. thiersii* (MushroomExpert.Com). The color chart used was the Online Auction Color Chart (Kramer, 2004). Subsequently, the specimens were dehydrated in a forced-air oven at 40 °C for 24 h and packaged in airtight plastic containers.

3. Results and Discussion

There are several taxa in the current list for the *Lepidella* section that occur without any woody ectomycorrhizal symbionts, such as *A. eremites*, *A. macerisolum*, *A. nauseosa*, *A. prairiicola*, *A. savannae*, and *A. thiersii*. In our findings, *A. thiersii* was found in a saprophytic litter layer over natural organic matter in an area dominated by

the Cerrado ecosystem, specifically, Cerradão (a mixture of sandy soil and saprolite). *A. thiersii* belongs to the *Amanita Vittadiniae* Bas. subsection. Taxa from this subsection occur in a variety of habitats, including high-altitude deserts, wet savannas, tropical and subtropical plains, high-altitude prairies, gardens, and residential lawns.

In this study, the environment most similar to those mentioned above is the wet savanna, which closely resembles the Cerradão of the Brazilian Cerrado domain. *A. thiersii* is found in Canada, the United States, Mexico, and Brazil, with its distribution spanning the entire Western Hemisphere (Tulloss, 2005).

Amanita thiersii (Figure 1), commonly known as Thiers' amanita, can be identified by several key features:

Cap: The cap is usually smooth, slightly sticky when wet, and ranges in color from yellow to orange-brown. It can measure 5-10 cm in diameter. The cap of *A. thiersii* is 35 - 100 mm wide, convex to conico-convex to plano-convex, mostly with a low, broad umbo, white, dry, sometimes slightly viscid with age, with a non-sulcate, appendiculate margin; cap flesh up to 10 mm thick. At first, the cap is entirely covered by soft, subpulverulent, lanose-floccose, squamulose, white volva; later becoming more or less glabrous with scattered, floccose-fibrillose to felted, patch- or scale-like, at center sometimes wart-like remnants of volva.

Gills: The gills are white, free from the stem, and densely spaced. The gills are crowded to subdistant, free, rather narrow to broad. In mass, they appear white to yellowish to creamy yellow or yellowish cream. In the side view, they are white to cream to yellowish cream and sometimes almost the color of egg yolk (in early stages of expansion). The short gills are attenuate to subattenuated to subtruncate to rounded-truncate, of many lengths, unevenly distributed, and rather common to plentiful.

Stem: The stem is 80 - 200 × 10 - 20 mm, equal, stuffed to hollow, white, bruising yellow in some specimens (associated with yellowing in other parts of the fruiting body and an odor of cheese). The bulb is merely a slight broadening of the stipe base, e.g., 25 × 22 mm. At first, below the ring is densely covered by lanose-squamulose volva, with age breaking into easily removable, incomplete, floccose-squamose girdles, finally becoming scanty flocculose-squamulose to merely fibrillose.

Odor/taste: The odor is described as indistinct, and may become unpleasant in age and then of decay or cheese (associated with yellowing specimens so far as is known). The taste is reported as oily bitter or bitter metallic.

Spores: Spores of *A. thiersii* measure (7.0-) 7.7 - 9.5 (-11.0) × (6.8-) 7.5 - 9.5 (-10.0) μm and are globose to subglobose (rarely broadly ellipsoid) and amyloid. Clamps are absent from the bases of basidia.

Stem: The stem is tall (5-15 cm), slender, and has a bulbous base. It often features a white volval ring at the base.

Spore Print: The spore print is white.

Habitat: This mushroom typically grows in wooded areas, often associated with oak or pine trees, during the late summer to fall. In our study, *A. thiersii* grows in litter on decomposing organic matter in a sandstone soil transforming (a mixture of sandy soil and saprolite).

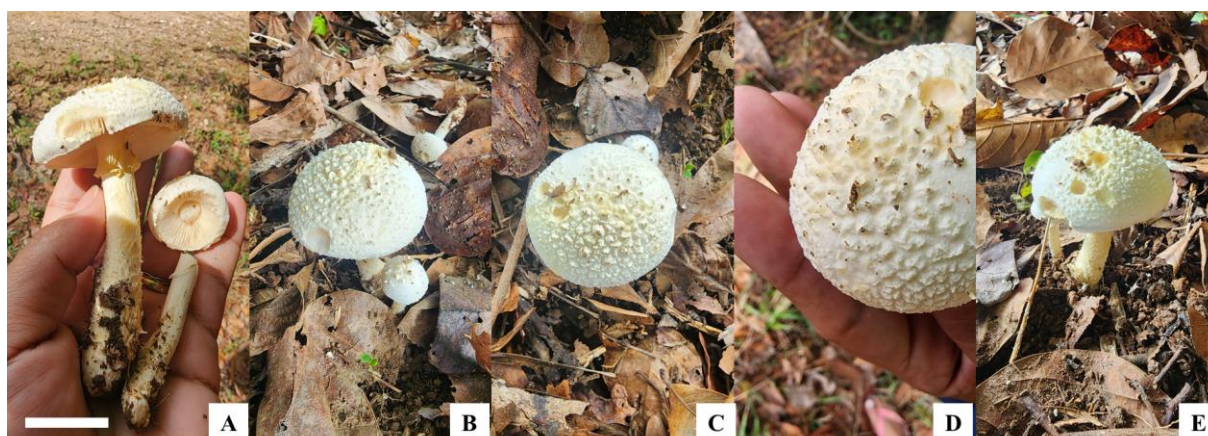


Figure 1. Em (A, B, C, D, and E) Scent = Indistinct, Cap = white Warts floccose-fibrillose 35-100 mm, Gills = Crowded, free, Ring = Apical, thin, easily torn, Stipe length = 80-200 mm, Stipe base Slightly enlarged and Volva evanescent, made of fibrillose warts. Bar in (A) = 10 cm long and 2 cm thick at the shaft. Source: Authors, 2024.

4. Conclusions

This is the first report of *Amanita thiersii* found in Brazil, specifically collected in an area of the Cerrado Domain, Cerradão type, in the Central-West region of Goiás. Further studies are needed to monitor this species in other areas across Brazil, as well as to conduct phytochemical characterization and investigate the biological activities of this mushroom species from the genus *Amanita*.

5. Acknowledgments

The authors would like to thank the Research Foundation of Brazil (National Council for Scientific and Technological Development (CNPq), the Coordination for Upgrading Higher Institution Personnel (CAPES); the Research Support Foundation of the State of Goiás (FAPEG) and the Financier of Studies and Projects (FINEP).

6. Authors' Contributions

Leonardo Fleuri Alves: writing of the study and specimen identification. *José Rodolfo Juvêncio Martins*: writing of the study, specimen identification, and revisions. *Antonio Carlos Pereira de Menezes Filho*: identification, revisions, and publication. *Tullyo Henrique Lima Machado*: collection, primary identification, secondary identification, writing of the study, and publication. *Vanêcia Oliveira Cunha Machado*: collection, primary identification, and text analysis. *Tiago Carnevalle Romão*: writing of the study and publication. *Matheus Vinícius Abadia Ventura*: advisor and research coordinator

7. Conflicts of Interest

No conflicts of interest.

8. Ethics Approval

Not applicable.

9. References

- Courtin, P., Gallardo, M., Berrouba, A. (2009). Renal failure after ingestion of *Amanita proxima*. *Clinical Toxicology*, 47(9), 906-908. <https://doi.org/10.3109/15563650903289485>
- Crispula, H. (1985). State lontani da *Amanita proxima*. *Micologia Veneta*, 1, 3-4.
- Cui, Y. Y., Cai, Q., Tang, L. P., Liu, J-W., & Yang, Z. L. (2018). The family Amanitaceae: molecular phylogeny, higher-rank taxonomy and the species in China. *Fungal Diversity*, 91(1), 5-230. <https://doi.org/10.1007/s13225-018-0405-9>
- Diaz, J. H. (2005). Syndromic diagnosis and management of confirmed mushroom poisonings. *Critical Care Medicine*, 33(2), 427-436. <https://doi.org/10.1097/01.CCM.0000153531.69448.49>
- Dunkirk, N., Wang, Y-W., Drott, M. T., Elmore, H., Robledo, G., Tulloss, R. E. (2023). *Amanita thiersii* and *Amanita foetens* and geographically distinct species, leaving the origins of *A. thiersii* and its range expansion enigmatic. *F1000 Research*, 12, 862. <https://doi.org/10.12688/f1000research.134814.1>
- Flammer R, Horak E. (2003). Giftpilze Pilzgifte. Pilzvergiftungen. Ein Nachschlagewerk für Ärzte, Apotheker, Biologen, Mykologen, Pilzexperten und Pilzsammler. Basel: Schwabe & Co. AG, Verlag und Druckerei, 204.
- Kirchmair, M., Carrilho, P., Pfab, R., Haberl, B., Felgueiras, J., Carvalho, F., Cardoso, J., Melo, I., Vinhas, J., & Neuhauser, S. (2012). *Amanita* poisonings resulting in acute, reversible renal failure: new cases, new toxic *Amanita* mushrooms. *Nephrology Dialysis Transplantation*, 27(4), 1380-1386. <https://doi.org/10.1093/ndt/gfr511>
- Kuo, M., Methven, A. (2010). 100 cool mushrooms. Ann Arbor: University of Michigan Press, 393 p.
- Leathem, A., & Purssell, R. (1995). Suspected *Amanita smithiana* mushroom poisoning resulting in renal failure. *Journal of Clinical Toxicology*, 33, 544.
- MushroomExpert.Com. The genus *Amanita*. <<https://www.mushroomexpert.com/amanita.html>>. Accessed

October 31, 2024.

- Tulloss, R. E. (2015). *Amanita thiersii* in Tulloss, R. E., & Yang, Z. L, eds. Studies in the Amanitaceae. <<http://www.amanitaceae.org?Amanita+thiersii>>. Accessed October 30, 2024.
- Tulloss, R. E. (2005). *Amanita* – distribution in the Americas with comparison to eastern and southern Asia and notes on spore character variation with latitude and ecology. *Mycotaxon*, 93, 189-231.
- Tulloss, R. E., & Yang, Z. (2011). <<http://www.amanitaceae.org>> Accessed October 30, 2024.
- Scheibler, G. (2019). Sistemática de *Amanita* Pers. (Amanitaceae, Basidiomycota) no Brasil. Dissertação de Mestrado em Biologia de Fungos, Algas e Plantas pela Universidade Federal de Santa Catarina, Florianópolis, Brasil, 176 p.
- Singer, R. (1953). Quelques Agarics nouveaux de l'Argentine. *Revue de Mycologie*, 18(1), 1-17.
- Wartchow, F. (2017). O gênero *Amanita* (Fungi): Sistemática e distribuição no Brasil. *Pesquisa e Ensino em Ciências Exatas e da Natureza*, 1(1), 28-44. <https://doi.org/10.29215/pecen.v1i1.165>
- West, P. L., Lindgren, J., & Horowitz, Z. (2009). *Amanita smithiana* mushroom ingestion: a case of delayed renal failure and literature review. *Journal of Medical Toxicology*, 5, 32-38.
- Wolfe, B. E., Kuo, M., & Pringle, A. (2012). *Amanita thiersii* is a saprotrophic fungus expanding its range in the United States. *Mycologia*, 104(1), 22-33. <https://doi.org/10.3852/11-056>

Funding

Not applicable.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).