

Myxomycetes from the butterfly garden of the Belo Horizonte Zoobotanical Complex: Additions to the Minas Gerais Myxobiota

Lucca de Araujo Toschi¹, Robson Bernardo Silveira-Silva¹ and Solange Xavier-Santos¹

¹ Laboratory of Basic and Applied Mycology and Scientific Dissemination (FungiLab), State University of Goiás, Anápolis, Brazil.

E-mail: lucca.toschi.bio@gmail.com

Received: 24 February 2025

Accepted for publication: 2 April 2025

Published: 10 April 2025

Editor: Steven L. Stephenson

Abstract: During a visit to the butterfly garden at the Zoobotanical Complex of Belo Horizonte, Minas Gerais, eight species of myxomycetes were recorded developing inside the greenhouse. These were *Arcyria cinerea*, *A. denudata*, *Badhamia polycephala*, *Diderma deplanatum*, *Hemitrichia serpula*, *Physarum compressum*, *Stemonaria longa*, and *Trichamphora pezizoidea*. Of these, *B. polycephala*, *D. deplanatum* and *P. compressum* were recorded for the first time in the state of Minas Gerais. These records contribute to the knowledge of the myxobiota of the state of Minas Gerais, which, in turn, has few records.

Keywords: anthropogenic environment, biodiversity, myxomycota.

This work is licensed under a Creative Commons Attribution 4.0 International License

In Brazil, the biodiversity of myxomycetes is represented by 263 species, predominantly found in the phytogeographic domains of the Atlantic Forest. However, certain regions within this domain, such as the states of Minas Gerais and Espírito Santo, lack detailed records due to a scarcity of basic studies in these areas (Flora and Funga 2024). This disparity is notable, with only 15 species reported from Minas Gerais and only four from Espírito Santo. The states of Pernambuco and São Paulo, on the other hand, have a list of 179 and 141 species, respectively (Flora and Funga of Brazil 2024), largely due to the activities of the research group led by L. H. Cavalcanti, which has conducted extensive surveys in these states. In the specific case of Minas Gerais, only one scientific article has been published on the subject thus far (Domingues et al. 2012), in which the authors describe the first record of *Diachea leucopodia* for such an area, observed growing on strawberry plants. More recently, at the X National Congress of Mycology (<https://cbmic2024.com.br>), Cavalcanti and Agra (2024) presented a list of myxomycete species for the state of Minas Gerais, which was compiled from herbaria data. This list contributed to the known geographic distribution of myxomycetes in the state.

During a visit to the Zoobotanical Complex of Belo Horizonte, sporocarps of myxomycetes were first found on, and then collected from, the flowerbeds of the butterfly garden (Fig. 1) within a greenhouse. Among the planted species there were members of Camará (*Lantana* sp.), sálvia-de-jardim (*Salvia splendens*), camarão-azul (*Eranthemum pulchellum*), falsa-érica (*Cuphea gracilis*), girassol-mexicano

(*Tithonia diversifolia*), and various species of the genus *Zinnia*, *Myosotis* or *Penta*. Currently, the butterfly garden maintains, on average, a thousand individuals of ten butterfly species naturally occurring in the Belo Horizonte region (Prefeitura Belo Horizonte 2024).

The sporocarps were found associated with plant debris in the flowerbeds inside the butterfly garden, collected, and placed in paper boxes, then taken to the Laboratory of Basic and Applied Mycology and Scientific Dissemination (FungiLab), where they were identified based on macroscopic and microscopic criteria, with the support of the literature by Martin and Alexopoulos (1969) and Poulain et al. (2011a and b). The color standards of Kornerup and Wansher (1978) were used, and the nomenclature was based on Lado (2024) and Garcia et al. (2023). Upon this process, the specimens were added to the collection of the HUEG-Fungi herbarium, in the University of Goiás State, Brazil.

The distribution of the species was considered based on the review of articles, conference proceedings and data available on platform Flora and Funga do Brasil (<https://floradobrasil.jbrj.gov.br/>). Considering the recent changes in the nomenclature of some Physaraceae species made by Garcia et al. (2023) and the fact that these changes are not yet updated in herbarium banks, the recent and old names were considered in the search for the distribution of the species *Badhamia polycephala* (formerly *Physarum polycephalum*) and *Trichamphora pezizoidea* (formerly *Physarum pezizoideum*).

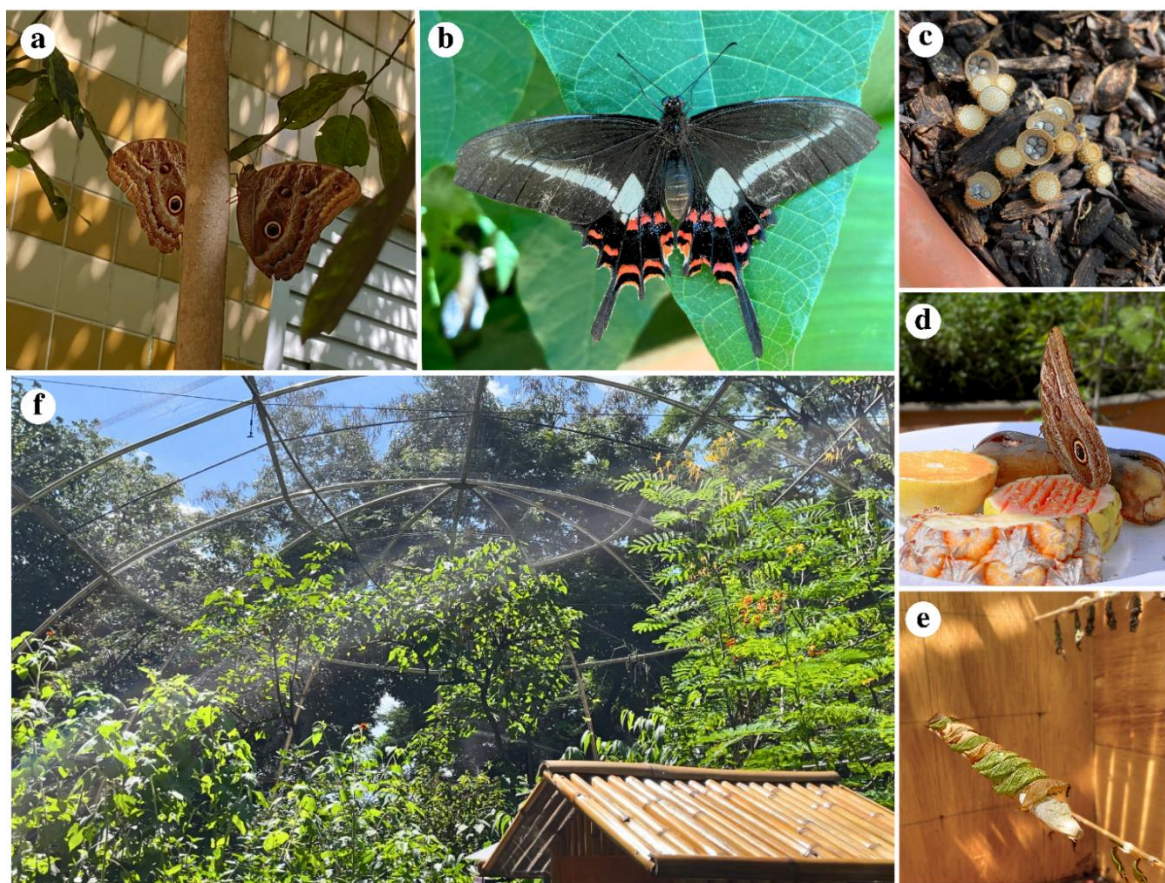


Figure 1. Indoor environment of the butterfly garden. a. *Caligo* sp. butterfly. b. *Heraclides* sp. butterfly. c. *Cyathus* sp. fungi developing in a potted plant. d. Butterfly feeding. e. Box with butterfly pupae. f. General overview of the greenhouse.

Species found

Eight species (*Badhamia polycephala**, *Diderma deplanatum**, *Physarum compressum**, and *Trichamphora pezizoidea*, *Arcyria cinerea*, *A. denudata*, *Hemitrichia serpula*, *Stemonaria longa*) were collected (Fig. 2).

- *Arcyria cinerea* (Bull.) Pers., Syn. meth. fung. 1:184 (1801)

Material analyzed: Brazil, Minas Gerais: Zoobotanical Complex: Butterfly Garden, 19°51'43"S 44°00'31"W, 24/II/2024, developing on dead wood, Toschi, LA 92 (HUEG 17118).

- *Arcyria denudata* (L.) Wettst., Verh. Zool.-Bot. Ges. Wien 35:535 (1886)

Material analyzed: Brazil, Minas Gerais: Zoobotanical Complex: Butterfly Garden, 19°51'43"S 44°00'31"W, 24/II/2024, developing on dead wood, Toschi, LA 91 (HUEG 17116).

- *Trichamphora pezizoidea* Jungh., Praem. fl. crypt. Java 12 (1838)

Material analyzed: Brazil, Minas Gerais: Zoobotanical Complex: Butterfly Garden, 19°51'43"S 44°00'31"W, 24/II/2024, developing on dead wood and on sporophores of *Stemonaria longa*, Toschi, LA 88 (HUEG 17113).

- *Badhamia polycephala* (Schwein.) J.M. García-Martín, J.C. Zamora & Lado, Persoonia 51:113 (2023)

Material analyzed: Brazil, Minas Gerais: Zoobotanical Complex: Butterfly Garden, 19°51'43"S 44°00'31"W, 24/II/2024, developing on dead wood, Toschi, LA 89 (HUEG 17114).

- *Diderma deplanatum* Fr., Syst. mycol. 3(1):110 (1829)

Material analyzed: Brazil, Minas Gerais: Zoobotanical Complex: Butterfly Garden, 19°51'43"S 44°00'31"W, 24/II/2024, developing on dead wood and leaf, Toschi, LA 93 (HUEG 17119).

- *Hemitrichia serpula* (Scop.) Rostaf. ex Lister, Monogr. mycetozoa, ed. 1, 179 (1894)

Material analyzed: Brazil, Minas Gerais: Zoobotanical Complex: Butterfly Garden, 19°51'43"S 44°00'31"W, 24/II/2024, developing on dead wood, Toschi, LA 95 (HUEG 17121).

- *Physarum compressum* Alb. & Schwein., Consp. fung. lusat. 97 (1805)

Material analyzed: Brazil, Minas Gerais: Zoobotanical Complex: Butterfly Garden, 19°51'43"S 44°00'31"W, 24/II/2024, developing on dead wood, together with *Arcyria denudata* (HUEG 17116), Toschi, LA 94 (HUEG 17120).

- *Stemonaria longa* (Peck) Nann.-Bremek., R. Sharma & Y. Yamam., in Nannenga-Bremekamp, Yamamoto & Sharma, Proc. Kon. Ned. Akad. Wetensch., C. 87(4):453 (1984)

Material analyzed: Brazil, Minas Gerais: Zoobotanical Complex: Butterfly Garden, 19°51'43"S 44°00'31"W, 24/II/2024, developing in dead wood, together with *Arcyria denudata* (HUEG 17116), Toschi, LA 90 (HUEG 17115).

Description of the new records for the state of Minas Gerais

Diderma deplanatum Fr., Syst. mycol. 3(1):110 (1829). (Fig. 2, g–g-2)

Plasmodiocarp of different sizes, 1.2–2.0 mm long and 0.5 mm high, with double peridium, gray (1B1), slightly scorched with dark brown (7F5) spots, presenting slight dehiscence in the meridian portion (Figure g-2). Hypothallus membranous, white (1A1), almost hyaline. Spore mass greyish brown (6F3) but spores globose, with small warts, 8–10 µm in diameter, brown (5F3). Capillitium light brown (5D4), with small warts, flattened close to the base and gradually turning hyaline, 2–4 µm in diameter.

Badhamia polycephala (Schwein.) J.M. García-Martín, J.C. Zamora & Lado, Persoonia 51:113 (2023). (Fig. 2, f)

Phaneroplasmodium yellow (1A8). Sporangium 0.8–1.0 mm in total height, and sporotheca vertically flattened, about 30% of the total size of the sporangium. Peridium delicate, showing general dehiscence, olive (1E3), scorched with greyish yellow (2B3) spots. Stalk membranous olive (2D5). Hypothallus inconspicuous. Spore mass dark brown (6F4), and spores globose, spinulose, ranging from 9–10 µm in diameter, grayish brown (5F3). Capillitium hyaline, with calcareous granules, gray (3B1) to grayish yellow (3C2).

Physarum compressum Alb. & Schwein., Consp. fung. lusat. 97 (1805). (Fig. 2, e)

Phaneroplasmodium white (1A1). Sporangia 0.6–0.9 mm in total height, and sporotheca vertically flattened, about 30% of the total size of the sporangium. Peridium persistent, greyish brown (7F3), scorched with white (1A1) warts. Stalk membranous, brownish grey (7F2). Hypothallus inconspicuous. Spore mass dark brown (6F4), and spores globose, spinulose, ranging from 9–12 µm in diameter, grayish brown (5F3). Capillitium hyaline, 2–4 µm in diameter, with calcareous granules, gray (3B1) to grayish yellow (3C2).

Note: The plasmodia of *Physarum compressum* and *Badhamia polycephala* were obtained by germinating the spores of the collected sporophores on a 5% agar-based culture medium. The sporotheca of each morphospecies was placed on an Elisa plate and, using tweezers, they were lightly crushed to release the spores. This material was then suspended in 30 µL of distilled water and homogenized by pulsing the pipette 10 times. All the liquid was transferred to the culture medium. After eight days, it was possible to observe the young plasmodium using a transmitted light microscope at 20x magnification. After 15 days, the plasmodia were already visible to the naked eye and were transferred to new Petri dishes under the same conditions. In all cases, oat flakes were used as food source. The same procedure did not work for *Diderma deplanatum*.

All the species recorded herein are cosmopolitan and have previously been noted in the Atlantic Forest phytogeographic domain of Brazil. However, *Badhamia polycephala*, *Physarum compressum* and *Diderma deplanatum* are recorded herein for the first time in the state of Minas Gerais. These observations contribute to the understanding of myxodiversity in such state and to the knowledge of myxomycetes present in anthropogenic environments.

Acknowledgements

We would like to thank CAPES (Fundação Coordenação de Aperfeiçoamento de Pessoal de Ensino Superior) for providing a scholarship to the authors Toschi LA and Silveira-Silva RB, and CNPq

(Conselho Nacional de Desenvolvimento e Pesquisa) for providing a productivity scholarship to Xavier-Santos S.

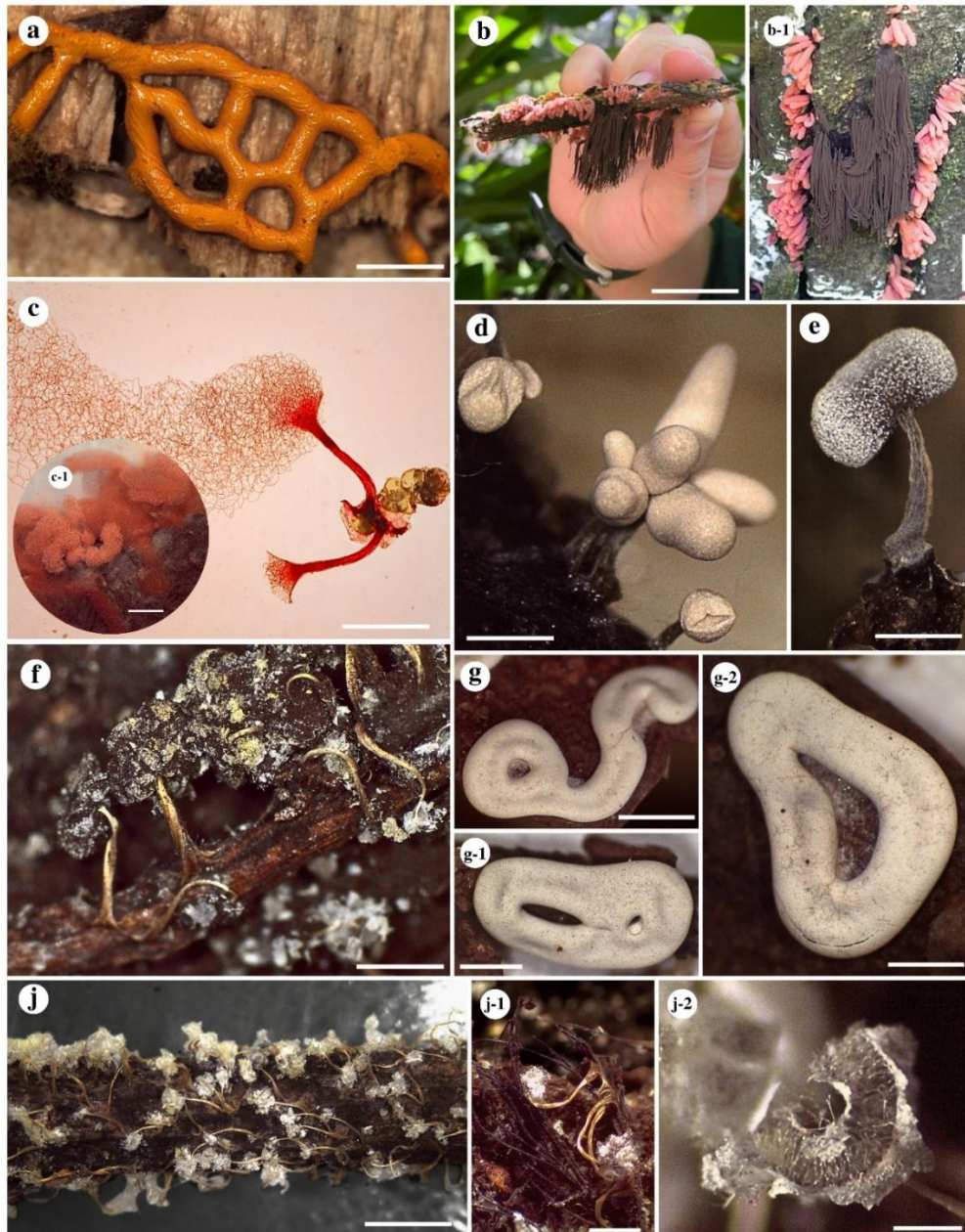


Figure 2. Myxomycetes found in the butterfly garden of the of the Belo Horizonte Zoobotanical Complex - Minas Gerais, Brazil. a. *Hemitrichia serpula*. b and b-1. *Stemonaria longa* and *Arcyria denudata*. c. *Arcyria denudata* in reflected light microscopy c-1. *Arcyria denudata* on wood. . *Arcyria cinerea*. e. *Physarum compressum*; f. *Badhamia polycephala*; g, g-1, g-2. *Diderma deplanatum*. j. *Trichamphora pezizoidea*. j-1. *T. pezizoidea* on *Stemonaria longa* sporangia residues. j-2. Details of the *T. pezizoidea* sporotheca. Scale bars: a = 0.7 mm; b=5 cm; b-1= 2 cm; c-1, g = 2 mm; c-f, g-1, g-2 = 0.4 mm; j, j-1= 1.5 mm; j-2= 0.25 mm.

References

- Prefeitura Belo Horizonte [Internet]. 2024. BH em cantos: Conheça o borboletário do jardim zoológico: Minas Gerais, Brasil: Prefeitura Belo Horizonte; [visited 2025 Jan 25]. Available from: <https://prefeitura.pbh.gov.br/noticias/bh-em-cantos-conheca-o-borboletario-do-jardim-zoologico>
- Cavalcanti LH, Agra LANN. 2024. Myxomycetes do estado de Minas Gerais, Sudeste do Brasil: Uma lista atualizada de espécies. Minas Gerais, Brazil: X Congresso Nacional de Micologia. 299 p.
- Domingues RJ, Tófoli JG, Ferrari JT, Nogueira EMDC. 2012. Primeiro registro de ocorrência de *Diachea leucopodia* (Bull.) Rostaf (1874) em cultivo de morangueiro no Brasil. Documento Técnico do Instituto Biológico de São Paulo 15: 1-9.
- Flora e funga do Brasil [Internet]. 2024. Myxomycota: Jardim Botânico do Rio de Janeiro, Brasil: Institute of Research Rio de Janeiro Botanical Garden [visited 2025 Jan 23]. Available from: <https://floradobrasil.jbrj.gov.br/consulta/ficha.html?idDadosListaBrasil=120170>
- García-Martín JM, Zamora JC, Lado C. 2023. Multigene phylogeny of the order Physarales (Myxomycetes, Amoebozoa): Shedding light on the dark-spored clade. P:MPEF. 51(1): 89-124.
- Gray WD, Alexopoulos CJ. 1968. The Biology of Myxomycetes. New York: The Ronald Press Company. 288 p.
- Lado C [Internet]. 2005-2025. An on-line nomenclatural information system of Eumycetozoa, Madrid: Real Jardín Botánico de Madrid, CSIC; [visited 2025 Jan 10]. Available from: <http://www.eumycetozoa.com>
- Martin GW, Alexopoulos CJ. 1969. The Myxomycetes. Iowa City, Iowa: University of Iowa Press. 561 p.
- Poulain M, Meyer M, Bozonnet J. 2011a. Les Myxomycètes. Guide de détermination. Tome 1. Sévrier: Fédération Mycologique et Botanique Dauphiné Savoie. 568 p.
- Poulain M, Meyer M, Bozonnet J. 2011b. Les Myxomycètes. Tome 2. Sévrier: Fédération Mycologique et Botanique Dauphiné Savoie. 551 p.