



Biology-Botany

Wood anatomy of *Myrcia glomerata* (Cambess.) G.P.Burton & E.Lucas (Myrtaceae)

Anatomia da madeira de *Myrcia glomerata* (Cambess.) G.P.Burton & E.Lucas (Myrtaceae)

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ABSTRACT

Myrcia glomerata (Cambess.) G.P. Burton & E. Lucas is a shrub or tree that can reach up to five meters in height, with a generally tortuous trunk and grayish bark. The wood of *M. glomerata* is moderately heavy and hard. The trunks are mainly used as firewood, charcoal, and for making small items, tool handles, boxes, and crates. A sample of *M. glomerata* wood was collected on the banks of the Rio do Peixe, in Tangará (SC), and a voucher was deposited into FLOR Herbarium. The anatomical procedures followed the usual techniques in wood anatomy. The main anatomical characteristics observed include growth rings, solitary pores of diffuse arrangement, tangential diameter between 50 and 100 µm and frequency of 5 to 20 vessels/mm²; simple perforation plates and small areolar pits, both ray-vascular and intervascular. It presents vasicentric tracheids with areolar pits. The fibers vary from thin to thick. The axial parenchyma occurs in tangential lines and thick bands, with diffuse arrangement and in aggregates. The rays are numerous (more than 12/mm), predominantly with two cells in width, heterocellular, with procumbent cells and square or erect marginal cells. The anatomy presents typical characteristics described for the family. The unprecedented presence of prismatic crystals and resins in the axial parenchyma is noteworthy, indicating possible environmental adaptations.

Keywords: Plasticity; Atlantic Forest; Microscopy

RESUMO

Myrcia glomerata (Cambess.) G.P. Burton & E. Lucas é um arbusto ou árvore que pode atingir até cinco metros de altura, apresentando um tronco geralmente tortuoso e casca acinzentada. A madeira de *M.*

glomerata é moderadamente pesada, e dura. Os troncos são utilizados principalmente como lenha, carvão, confecção de pequenas peças, cabos de ferramentas, caixas e engradados. Uma amostra de madeira de *M. glomerata* foi coletada à margem do Rio do Peixe, em Tangará (SC), e um voucher foi depositado no Herbário FLOR. As preparações anatômicas seguiram as técnicas usuais em anatomia da madeira. As principais características anatômicas observadas incluem: anéis de crescimento distintos, poros solitários de arranjo difuso, com diâmetro tangencial entre 50 e 100 μm e frequência de 5 a 20 vasos/ mm^2 ; placas de perfuração simples e pontoações areoladas diminutas, tanto raio-vasculares quanto intervasculares. Apresenta traqueídes vasicêntricas com pontoações areoladas. As fibras variam de parede fina a espessa. O parênquima axial ocorre em linhas tangenciais e faixas espessas, com arranjo difuso e em agregados. Os raios são numerosos (mais de 12/ mm), predominantemente de duas células de largura, heterocelulares, com células procumbentes e marginais quadradas ou eretas. A anatomia apresenta características típicas descritas para a família. Destaca-se a presença inédita de cristais prismáticos e resinas no parênquima axial, indicando possíveis adaptações ambientais.

Palavras-chave: Plasticidade; Mata Atlântica; Microscopia

1 INTRODUCTION

Myrcia glomerata (Cambess.) G.P. Burton & E. Lucas, previously known as *Calyptranthes concinna* DC., is a shrub or small tree reaching up to five meters in height, characterized by a generally tortuous trunk and grayish bark. It is popularly known in Brazil as “guamirim-facho”, “guamirim”, or “camboim-ferro” (Lombardo, 1964). The species belongs to the family Myrtaceae, which includes shrub and tree species currently represented by approximately 130 genera and about 6,500 species (POWO, 2024). *Myrcia glomerata* occurs in the Southern Brazilian Plateau and Uruguay, primarily in riparian forests and forest patches. It prefers alluvial, compacted, and moist soils, and is classified as a heliophytic and selectively hygrophytic plant (Lombardo, 1964; Legrand & Klein, 1971). Due to its distribution in riparian forests, it plays a special role in maintaining local and regional biodiversity (Wuerges et al., 2024).

The wood of *M. glomerata* is moderately heavy, hard, and features interlocked fibers. Although it is not considered highly durable and has a reduced trunk diameter, it holds regional economic significance. Its main uses include firewood, charcoal, small handcrafted items, tool handles, crates, and boxes (Marchiori & Brum, 1997; Lorenzi, 2002). In a bibliographic study on fishing communities, the Myrtaceae family was

noted for its diverse applications, such as basketry, boat building, fishing gear, and bait-related utensils (Mendoza et al., 2023).

In addition to its ecological and economic relevance, *M. glomerata* has also shown phytochemical applications. A study developed by Batista et al. (2024) identified the presence of saponins, free steroids, alkaloids, anthocyanins, flavones, tannins, among other compounds, demonstrating antioxidant, antimicrobial, and antibiofilm activity *in vitro*. The essential oil extracted from the leaves, analyzed using gas chromatography coupled with mass spectrometry (GC-MS), revealed 29 chemical compounds, corresponding to 97.54% of its total composition.

The Myrtaceae family presents a pantropical distribution (Melo et al., 2023) and its highest diversity in the Southern Hemisphere, particularly in former Gondwanan regions (Thornhill et al., 2015). In Brazil, Myrtaceae is represented by about 29 genera and 1,208 species listed in the *Flora e Funga do Brasil* (2024). All Brazilian species of Myrtaceae belong to the tribe Myrteae (Wilson et al., 2005; Lucas et al., 2007), known for its taxonomic complexity and high species diversity, largely due to the genera *Myrcia* and *Eugenia* (Landrum & Kawasaki, 1997).

Wood anatomical characteristics of the Myrtaceae family include diffuse porosity, solitary vessels with simple perforation plates, vestured and alternate intervessel pits, and the absence of spiral thickenings (Record & Hess, 1949; Metcalfe & Chalk, 1972; Santos et al., 2013). The family commonly presents apotracheal axial parenchyma, thick-walled fibers, and heterocellular rays (Dias-Leme et al., 1995). The occurrence of prismatic crystals in the parenchyma is also typical, contributing to the general anatomical pattern of Myrtaceae (Franceschi & Nakata, 2005; Nakata, 2012).

The genus *Myrcia* comprises 410 Brazilian species, 321 of which are endemic (Santos et al., 2026). It forms a monophyletic group confirmed by genetic analyses (Lucas et al., 2007), characterized morphologically by oliaceous cotyledons, soft testa, a mean of five ovules per locule, ovules arising at a single point on the septum (usually below the midpoint), and absence of scalariform plates. *Myrcia* is one of the largest

genera of angiosperms with exclusively Neotropical species (POWO, 2024), widely distributed across the Atlantic Forest, Cerrado, Amazon Rainforest, and Caribbean (GBIF, 2023). The genus currently includes taxa formerly classified as *Gomidesia* O. Berg, *Marlierea* Cambess., and *Calyptranthes* Sw. (Lucas et al., 2011; Wilson et al., 2016). However, findings by Lucas et al. (2005) and Lucas et al. (2007) suggest that these four genera form a poorly resolved monophyletic group, within which *Myrcia* and *Marlierea* are paraphyletic, with *Gomidesia* and *Calyptranthes* nested within them.

Despite its practical uses, the anatomical features of *M. glomerata* wood remain underexplored. The first and only anatomical description was published by Marchiori & Brum (1997), based on samples collected in São Sepé, Rio Grande do Sul, Brazil. Since then, no updated studies have been conducted, revealing a critical gap in anatomical knowledge of this species. This study presents new anatomical data for *M. glomerata*, including newly documented color microphotographs and comparative analyses of structural plasticity. These findings update and expand current knowledge, emphasizing the value of descriptive botany as a foundation for further studies in ecological anatomy, conservation, and forest resource management.

2 MATERIAL AND METHODS

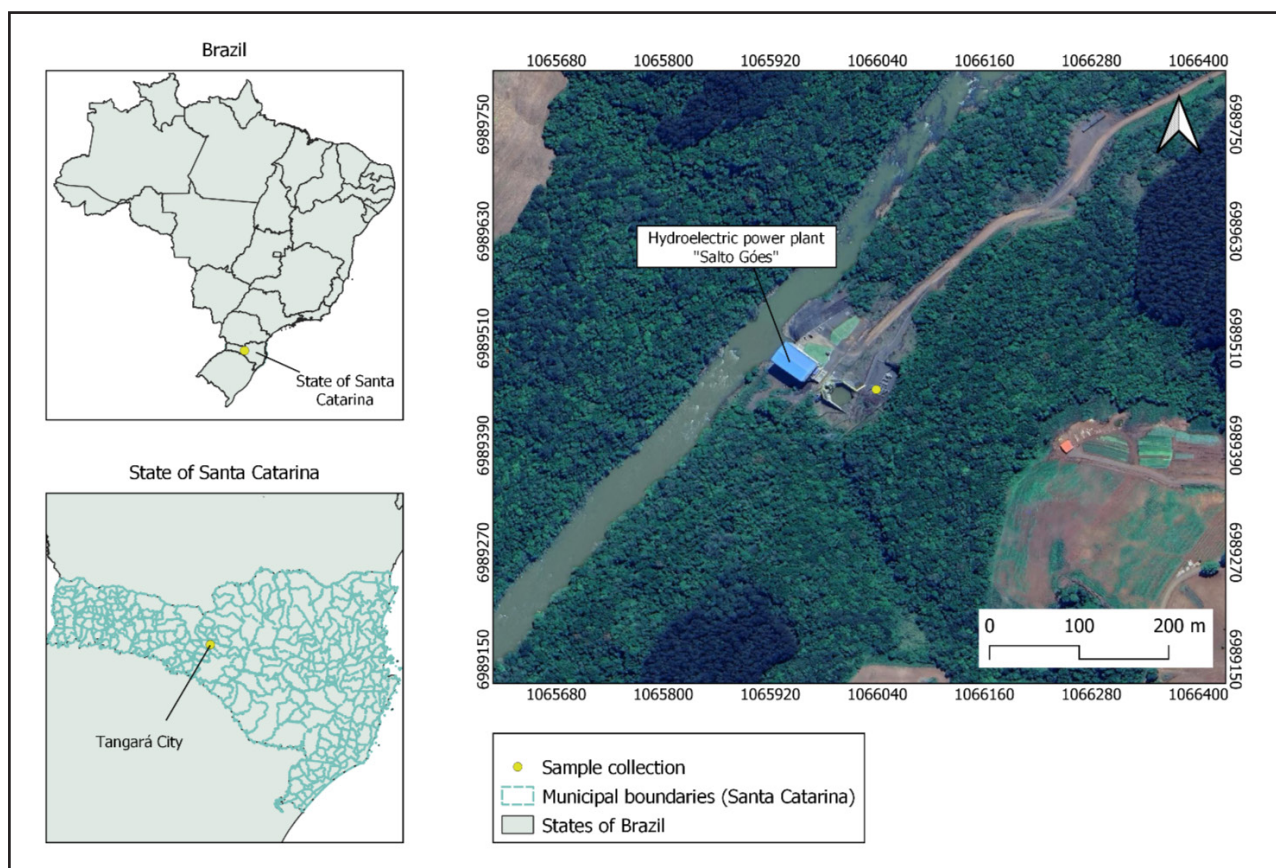
2.1 Collection data

The wood of *M. glomerata* was collected by F. B. Guimarães on June 14, 2011, at the bank of the river known as “Rio do Peixe”, in an area cleared for the construction of the Small Hydroelectric Power Plant – PCH “Salto Góes”, in the municipality of Tangará, Santa Catarina, Brazil (Figure 1). The specimen measured 1.5 meters in height, and three wood discs were collected from the trunk at breast height. The voucher specimen (dried specimen and wood) was deposited in the FLOR Herbarium of the Federal University of Santa Catarina – UFSC, under the code FLOR0039662, and a wood slide

was prepared. A duplicate was incorporated into the JOLw xylotheque collection. This histological slide was used to describe the wood presented in this study.

The Tangará region has a humid temperate climate with mild summers (Cfb), according to the Köppen-Geiger classification, characterized by moderate temperatures and well-distributed precipitation throughout the year, with no dry season (Epagri, 2003). The predominant phytophysiology is Mixed Ombrophilous Forest, belonging to the Atlantic Forest biome (SOS Mata Atlântica, 2018).

Figure 1 – Collection site location map



Source: Authors (2026). UTM coordinate system, SIRGAS 2000 datum, Zone 22S. Consulted source: Google Earth Pro, IBGE

2.2 Preparation and anatomical description

Anatomical preparations followed standard wood anatomy techniques (Johansen, 1940; Sass, 1951; IAWA, 1989). The specimens were softened by boiled water

and glycerin (Ferreirinha, 1958). Sections were cut in the usual planes: transverse, radial longitudinal, and tangential longitudinal in a sliding microtome. They were clarified with sodium hypochlorite (NaClO), rinsed with distilled water, stained with safranin and astra blue, and dehydrated in an increasing ethanol series (Kraus & Arduin, 1997). Permanent slides were mounted using synthetic resin as described by Paiva et al. (2006). The anatomical description followed the terminology recommended by the IAWA Committee (1989).

Microscopic structures were observed using an Olympus CX31 transmitted light microscope. Mineral inclusions were examined using polarized light with the same equipment. Photomicrographs were taken using an OPTICAMO600RT photomicroscope. Quantitative data are presented as (min – mean \pm standard deviation – max).

3 RESULTS

The wood anatomy of *Myrcia glomerata* is described and illustrated below (Figure 2).

Growth rings: boundaries distinct, marked by the thickening of radial walls of fibers.

Vessels: diffuse porosity; diffuse arrangement; exclusively solitary; simple perforation plates; intervessel pits alternate, predominantly small, occasionally minute (3.91–5.95 \pm 1.03–7.39 μ m); vessel-ray pits with distinct borders, similar to intervessel pits in size and shape throughout the ray cell; mean tangential diameter of vessel lumen between 50 and 100 μ m (50.47–77.52 \pm 19.28–133.38 μ m); frequency of 5 to 20 vessels/mm² (5–9.3 \pm 2.59–14);

Tracheids and fibers: presence of vasicentric tracheids with areolate pits; fibers with simple to minutely bordered pits; fiber wall thickness ranges from thin to thick in earlywood and becomes thicker in latewood.

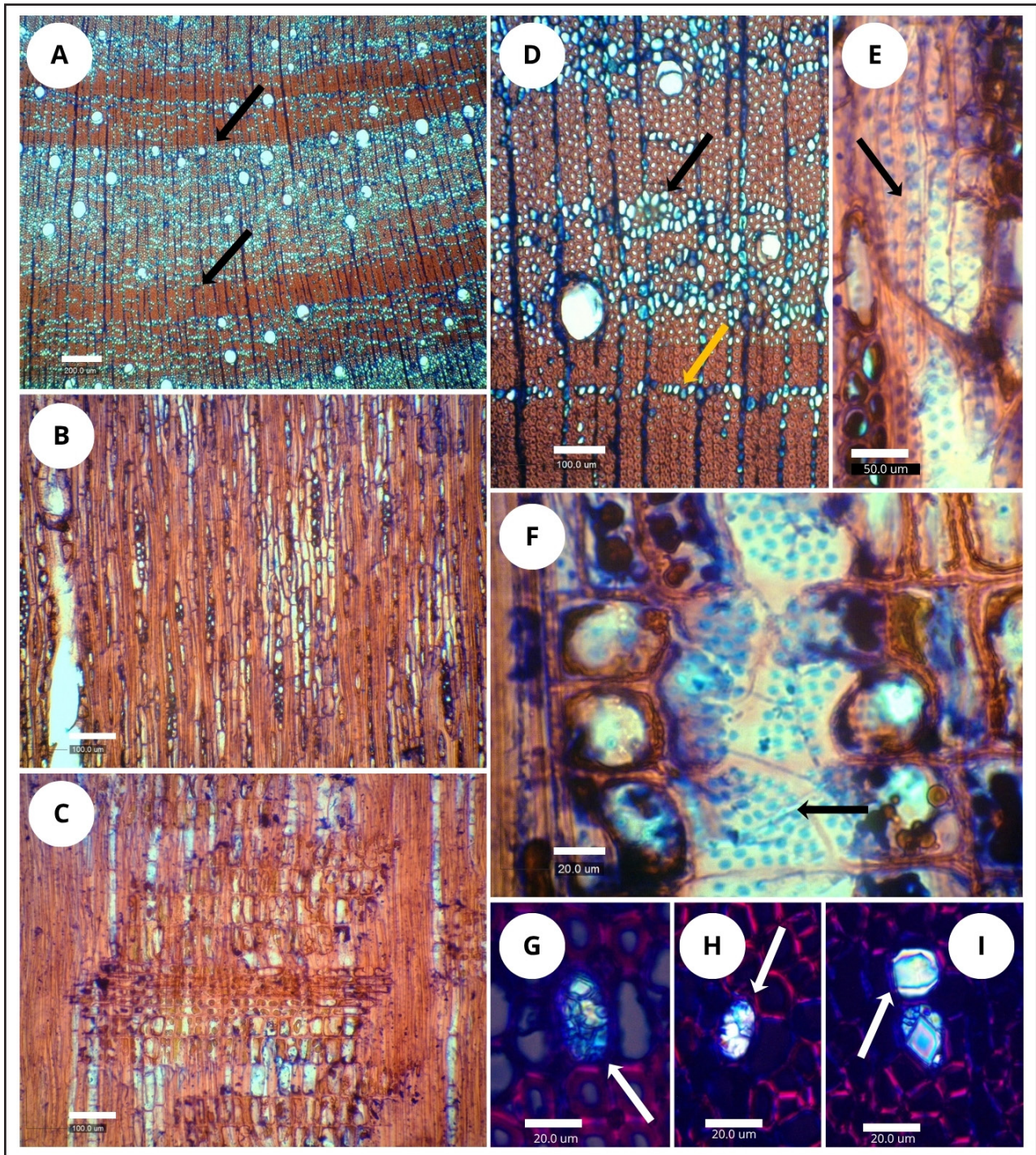
Axial parenchyma: apotracheal diffuse; diffuse-in-aggregates; in tangential lines one cell wide and occasionally more than three cells wide.

Rays: one to three cells wide ($7.90\text{--}18.54 \pm 4.45\text{--}28.67 \mu\text{m}$), most frequently 2 cells; height below 1 mm ($112.06 - 175.37 \pm 41.66 - 276.96 \mu\text{m}$); heterocellular, with body composed of procumbent cells with over 4 rows of upright and/or square marginal cells; more than 12 rays per millimeter.

Mineral inclusions and other deposits: prismatic crystals occurring in non-chambered axial parenchyma cells, druses occurring within fibers; presence of crystals of other shapes (mostly small); and resins or gums present in radial parenchyma;

Suggestions of numbers and codes, according to the InsideWood format: 1p 5p 9p 13p 22p 24p 25p 30p 41p 47p 60p 69p 76p 77p 85p 86p 97p 102a 108p 116p 136p 137p 138p 142p 144p 147p 152p.

Figure 2 – Wood anatomy of *Myrcia glomerata* (Myrtaceae)



Source: Authors (2026). A) Diffuse porosity and distinct growth rings (arrow) in transversal section. B) 1-3 seriate rays in tangential longitudinal section. C) Heterocellular rays in radial longitudinal section. D) Axial parenchyma in lines (yellow narrow) and lines up to three cells wide (black arrow). E) Vasicentric tracheids (arrow). F) Vessel-ray pits (arrow). G) Druses (arrow). H) Crystals of other shapes (arrow). I) Prismatic crystals (arrow)

4 DISCUSSION

The results of this study confirm anatomical characteristics widely reported for the Myrtaceae family, such as simple perforation plates, vestured pits, vasicentric tracheids, thick-walled fibers, and heterocellular rays (Record & Hess, 1949; Dias-Leme et al., 1995), as well as the occurrence of solitary pores and apotracheal axial parenchyma (Metcalf & Chalk, 1972; Santos & Marchiori, 2011). Record & Hess (1949) also mention the absence of spiral thickenings in vessels, except in two species of *Myrceugenia*. However, some divergences and particularities were observed, highlighting anatomical variations within the genus *Myrcia*, as discussed below.

The absence of spiral thickenings is common in tropical plants, as reported by Alves & Angyalossy (2000), whose study showed that only 2% of the 491 evaluated species presented such a feature. Within the Myrtaceae family, spiral thickenings were observed in only 33 of the 144 species studied by Schmid & Baas (1984) and in 1 of the 31 species analyzed by Dias-Leme et al. (1995).

Diffuse porosity was reported in all 24 species of the Myrtaceae family (genera *Myrciaria*, *Neomitranthes*, *Plinia*, and *Siphoneugena*) evaluated by Santos et al. (2013), which aligns with our findings, as well as in nine species of the genus *Eugenia* analyzed by Santos, Marchiori, and Sieglöch (2014), all belonging to Myrtaceae.

Vasicentric tracheids are structures adjacent to vessels that act as a subsidiary conduction system in the event of vessel embolism, increasing hydraulic safety. Therefore, their presence is more common in water-limited areas (Carlquist, 1985). The presence of such structures in the species studied here suggests that even in riparian forests with well-distributed rainfall throughout the year, water availability may show microvariations due to alluvial soil compaction or subtle seasonal fluctuations in the water table, for example.

Heterocellular rays, composed of different cell types, reflect a primitive phylogenetic condition among woody angiosperms (Kribs, 1935; Baas, Wheeler & Chase, 2000). This feature was reported in *Campomanesia xanthocarpa* Berg., *Eugenia*

pyriformis Cambess, *Myrcia retorta* Cambess, and *Plinia peruviana* (Poir.) Govaerts, all from the Myrtaceae family (Stange et al., 2018), as well as in 31 species representing four genera of the subtribe Myrciinae (*Calypttranthes*, *Gomidesia*, *Marlierea*, and *Myrcia*) (Dias-Leme et al., 1995), indicating that heterocellular rays represent a common trait across the family.

The presence of distinct growth rings is commonly found in species from temperate climates but is not typical in most tropical woody species (Alves & Angyalossy, 2000; Wheeler et al., 2007) nor in most Myrtaceae species (Dias-Leme et al., 1995). However, it has been reported in *Myrcia bombycina* (O.Berg) Niedenzu (Marchiori & Santos, 2009) and *Myrcia myscrophilla* Kiaersk (Silva et al., 2024). Growth ring formation is related to cambial activity in response to environmental factors such as rainfall and temperature (Tomazello-Filho, Botosso & Lisi, 2001). Diffuse porosity, in turn, is commonly found in most tropical species (IAWA, 1989).

The predominance of solitary vessels was described for several species in the Myrtaceae family by Stange et al. (2018) and Dias-Leme et al. (1995), which agrees with the findings of this study.

Our findings of prismatic crystals in subdivided chambers of the axial parenchyma, as well as resins or gums in the radial parenchyma, differ from the description by Marchiori & Brum (1997), who reported the absence of crystals or other materials in the wood parenchyma. Dias-Leme et al. (1995) pointed out that the presence of crystals in the parenchyma is a common characteristic in the genus *Myrcia*, recorded in 10 of the 14 species evaluated. The presence of these crystals is associated with functions such as physical protection, calcium salt storage, oxalate removal from the metabolic system, and light organization during photosynthesis (Franceschi & Nakata, 2005).

Plasticity in the formation — or absence — of crystals may be linked to calcium regulation in plants. Under excess calcium conditions, the crystals appear to play a role in calcium sequestration in adjacent cells. However, when calcium becomes scarce in

the environment, the crystals dissolve, enabling growth and metabolic maintenance of the plant (Nakata, 2012).

Crystal formation is also influenced by urbanization, acting as a response to exposure to gaseous pollutants. Plants act as biological filters, helping to remove pollutants and maintain ionic balance, as well as incorporating heavy metals into oxalate crystals, as demonstrated by Alves et al. (2008) in *Eugenia uniflora* L. (Myrtaceae) exposed to urban pollution in São Paulo, Brazil.

Thus, the observed divergence may be explained by possible ontogenetic, environmental, or methodological differences. Although the size and quantity of crystals may vary among different taxa, their shape and location within a taxon are usually specific and may be considered taxonomic features (Franceschi & Nakata, 2005).

The presence of alternate intervessel pits was reported in nine species of the genus *Eugenia* studied by Santos, Marchiori, and Sieglösch (2014), all belonging to the Myrtaceae family. Intervessel pits were also described in 26 species of the Myrtaceae family investigated by Santos (2012), including two species from the genus *Myrcia*: *M. bombycina* (O.Berg) Niedenzu and *M. selloi* (Spreng.) N.Silveira. However, the study by Marchiori and Brum (1997) reports the absence of these structures in *Myrcia glomerata*, which differs from our findings and represents an unusual observation within the Myrtaceae family. However, the absence or limited visibility of intervessel pits is expected in species with exclusively solitary vessels, as vessel contacts are infrequent or only occasional (Esteban et al., 2024).

A higher number of intervessel pits increases the likelihood of leaky pit membranes, facilitating embolism propagation; which acts as an adaptive response to drought (Wheeler et al., 2005; Christman et al., 2009; Levionnois et al., 2021). Although structural variations in intervessel pits—such as differences in size and wall thickness—are well documented and appear to reflect responses to environmental conditions or the ontogenetic stage of the plant (Wheeler et al., 2005; Christman et al., 2009; Levionnois et al., 2021), no study was found that reported plasticity regarding

the complete presence or absence of these pits within individuals of the same species. This makes the discrepancy observed in *Myrcia glomerata* particularly notable and inspires further investigation.

5 CONCLUSION

This study contributes to the anatomical understanding of the wood of *Myrcia glomerata*, expanding knowledge about its structural characteristics and comparisons with other species of the Myrtaceae. The observations made indicate that the anatomy of this species follows many of the typical patterns of the family, such as the presence of solitary vessels, vasicentric tracheids, and heterocellular rays, in addition to characteristics less common in tropical species, such as distinct growth layers. The analysis also revealed the unprecedented presence of prismatic crystals in the axial parenchyma and resins or gums in the radial parenchyma, which differs from previous studies and may suggest specific adaptations to the environment in which the plant occurs.

The study also inspires future research on anatomical variations within the genus *Myrcia*, mainly due to the differences found in comparison with previous studies. These findings may contribute both to the understanding of the plant and to the use of its natural resources.

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