Secondary Xylem of Tree Species from Cerrado Biome

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Cerrado is the second largest Brazilian morphoclimatic domain. Despite being a region of great ecological importance, it has been the target of constant threats caused by anthropogenic activities, mainly those related to agriculture and livestock farming. With a rich biodiversity still not fully known and constantly being devastated, the Cerrado lacks studies. The objective of this study was to microscopically analyze the wood of Cerrado tree species. Wood samples were collected from nine tree species in a Cerrado area located in Monte Carmelo, Minas Gerais. Microscopic analyses were carried out on permanent histological slides and macerated material, following IAWA Committee standards. This work provided information on species whose wood had not been previously described in the literature, such as *Machaerium opacum* and *Eugenia dysenterica*, as well as on previously described species.

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INTRODUCTION

Forests are important sources of wood, non-timber forest products, and ecosystem services. The Cerrado is a savannah ecosystem that dominates the Brazilian central plateau. It is characterized by a strongly seasonal climate with distinct and regular rainy and dry periods. This biome encompasses forest, savannah, and grassland formations with different phytophysiognomies in each formation. The Cerrado is a highly diverse and complex ecosystem, and there can be variations and transitions between these phytophysiognomies, creating a mosaic of different vegetation types across the landscape. The Cerrado in the strict sense is characterized by the presence of defined tree and shrub-herbaceous strata, with trees randomly distributed over the terrain in different densities, without forming a continuous canopy (Aguiar and Carmargo 2004).

The trunk of trees is composed of wood, which is the secondary xylem tissue that connects the components of the plant body. Xylem performs multiple functions such as water transport, mechanical support, and storage. For most angiosperms, these functions are performed by different types of cells: vessels conduct water, fibers provide mechanical support, and parenchyma stores nutrients and water (Dutra *et al.* 2023). Although the anatomical characteristics of the wood provide a detailed view of the properties and functionalities of the tissues, as well as the ecological and adaptive strategies of the species (Chave *et al*. 2009; Gupta *et al.* 2017; Siam *et al.* 2023), the qualitative characteristics are maintained, thus providing a tool for species identification by observing the anatomical characteristics.

The identification of wood by its anatomy is an essential tool in the fight against illegal logging that occurs with great intensity in tropical forests, mainly in the Brazilian Amazon. The wrong classification of species is a general problem, as also commented by Siam *et al*. (2023). The cited work states that timbers from Anacardiaceae in Malaysia are sold as mixed species or used as general utility timbers due to a lack of information for identification and wood properties.

The least predatory way of exploiting forest resources is through sustainable forest management, which consists of exploiting forest resources to obtain economic, social and environmental benefits, respecting the ecosystem's sustaining mechanisms. In this way, by correctly managing the forest, it is possible to supply the high demand for timber and non-timber forest products, in addition to mitigating the damage caused in the region, allowing resources to be renewed (Rodrigues *et al*. 2020). In order to achieve this management, it is necessary to understand the dynamics of the ecosystem, it is necessary to have information about the individuals that compose it.

The objective of this work was to carry out the anatomical description of the wood of nine tree species occurring in the Cerrado of Minas Gerais.

EXPERIMENTAL

Nine species belonging to seven different families were studied. From each species, three individuals were collected. The species were collected in an area of fragment of Cerrado s.s. in the municipality of Monte Carmelo, MG (18°41'S, 47°30'W). The area was chosen because the owner had authorization to cut the trees in the course of replacing the area with agricultural culture. In this way, the material was used for the present study. The wooden disks were removed at a height of 1.30 m. On a band saw, the specimens were removed from each wooden disk for the production of histological slides and macerated.

Among the species selected for this study is *Caryocar brasiliense*, popularly known as "pequi". It is a species recognized and declared, according to Brazilian Law nº. 20.308, of July 27, 2012, as a permanent preservation, of common interest and immune to cutting throughout the state of Minas Gerais. For this reason, the collected samples came from branches, being chosen those closest to the main trunk.

The identification of the species was based on vegetative characters and, when available, with the aid of reproductive characters as well.

For the microscopic analysis of the wood, permanent histological slides were prepared. The test specimens were softened using saturation and heating techniques. In order to obtain the sections of the *Strychnos pseudoquina*, it was necessary to impregnate the wood in polyethylene glycol (PEG 1500).

With a sliding microtome, cuts with 8 to 20 µm thickness were obtained in the transverse, tangential, and radial planes of the wood. The cuts were clarified in 2% sodium hypochlorite and stained with Safranin 1%. Only for the species *Strychnos pseudoquina*, the stain safrablau (safranin + astra blue) was used to obtain the transverse section. Once stained, the cuts went through an alcoholic series with increasing concentrations (30%, 50%, 70%, 80%, 96%, and 100%) and alcohol/butyl acetate solutions in the ratio of 3:1, 1:1, and 1:3, and finally pure butyl acetate. Afterwards, the histological slides were mounted with Entellan® for permanent preservation of the cuts. Three permanent slides were made for each sampled individual.

To perform individual analysis of the wood cells, maceration was carried out. Using a scalpel, longitudinal chips were removed from the collected test specimens and deposited in a solution of acetic acid and hydrogen peroxide in a 1:1 ratio, in tightly closed containers. The mixture was then placed in an oven at 60 °C for a period of 24 hours. The material was washed in distilled water to eliminate the macerating solution and subsequently stained with Safranin 1%. Provisional slides were made for observation of the material under a light microscope.

Quantitative and qualitative descriptions of the wood were made following the guidelines of the International Association of Wood Anatomists Committee - IAWA Committee (1989).

RESULTS AND DISCUSSION

The following species were sampled and studied.

Table 1. Species Collected and Described in this Work

Species	Family
Aspidosperma tomentosum	Apocynaceae
Caryocar brasiliense	Caryocaraceae
Dalbergia miscolobium	Fabaceae
Hymenaea stigonocarpa	Fabaceae
Machaerium opacum	Fabaceae
Strychnos pseudoquina	Loganiaceae
Eugenia dysenterica	Myrtaceae
Roupala montana	Proteaceae
Pouteria ramiflora	Sapotaceae

Among the studied species, two, *Machaerium opacum* and *Eugenia dysenterica*, had not yet had their anatomical description described in the literature.

The anatomical descriptions of the woods of the species studied in this work are presented below.

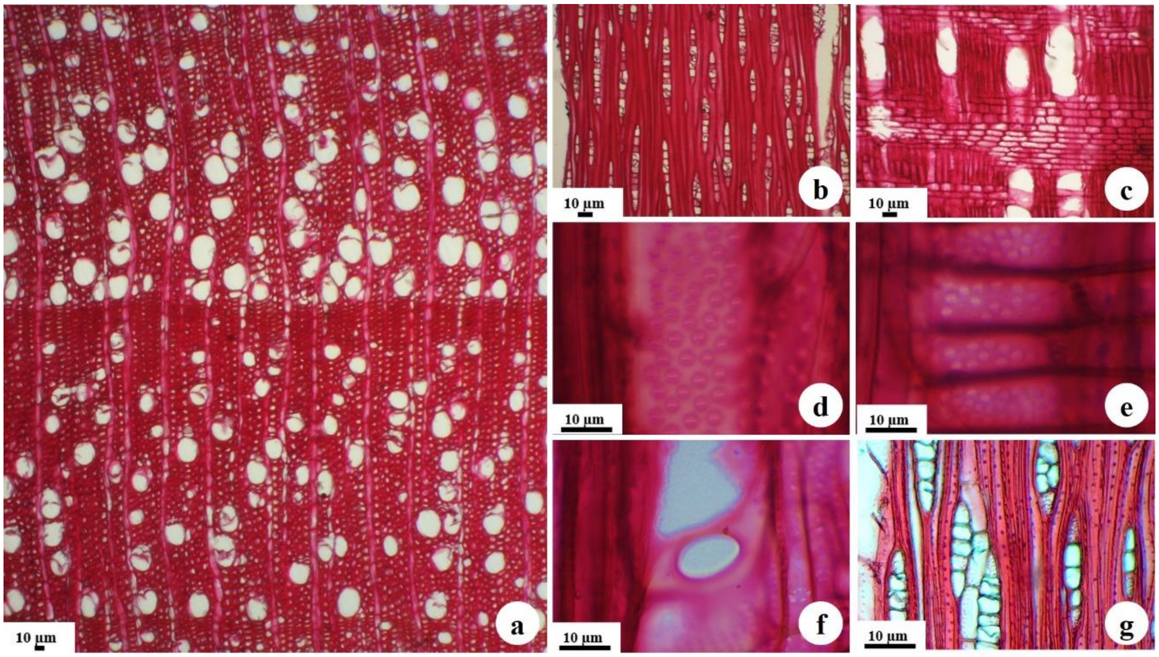

Fig. 1. Microscopy of *Aspidosperma tomentosum* wood. (a) transverse section; (b) tangential section; (c) radial section; (d) intervessel pits; (e) vessel–ray pits; (f) simple perforation plate; (g) areolate pits in fiber wall tangential.

Growth ring distinct: marked by fibrous zones. **Vessels**: wood diffuse porous, with no clear arrangement, predominantly solitary (92%), vessel frequency 39 (18 to 61) vessels/mm². Perforation plates simple, mean tangential diameter 54.03 (23.71 to 102.51) µm, Vessel elements with a length of 553.23 (280.32 to 873.50) µm, intervessel pits alternate and vessel-ray pits similar to intervessel pits in size and shape. **Axial parenchyma**: diffuse and diffuse-in-aggregates. **Rays**: Ray width 1 to 3 cells; with a width of 26.50 (17.3 to 47.34) µm, consisting of approximately 9 (3 to 23) cells and a height of 237.59 (122.17 to 522.9) µm; heterocellular rays, composed of both procumbent and square cells. The frequency is 7 (3 to 12) rays per linear millimeter. **Fibers**: Mean fibre length 1281.06 (922.54 to 1752.31) µm, mean wall thickness 7.07 (4.19 to 9.74) µm in thickness; non-septate; distinctly bordered pits. **Secretory elements**: not observed. **Mineral inclusions**: none observed.

The description made for *A. tomentosum* is quite consistent with those found in other studies. However, Leon (2011); Sonsin *et al.* (2014) and De Faria *et al.* (2020) mention the occurrence of marginal parenchyma delimiting the growth rings, which were not observed in this study. Leon (2011) described vasicentric tracheids, Sonsin *et al.* (2014) mention the presence of perforated ray cells, and Faria *et al*. (2020) describe absent or rare axial parenchyma *A. tomentosum*.

For Apocynaceae, present growth rings, simple perforation plates, commonly apotracheal axial parenchyma, and uniseriate rays are characteristic anatomical features (Record and Hess 1949; Metcalfe and Chalk 1950). Record and Hess (1949) also cite predominantly solitary pores and homogeneous rays as typical of the genus *Aspidosperma*.

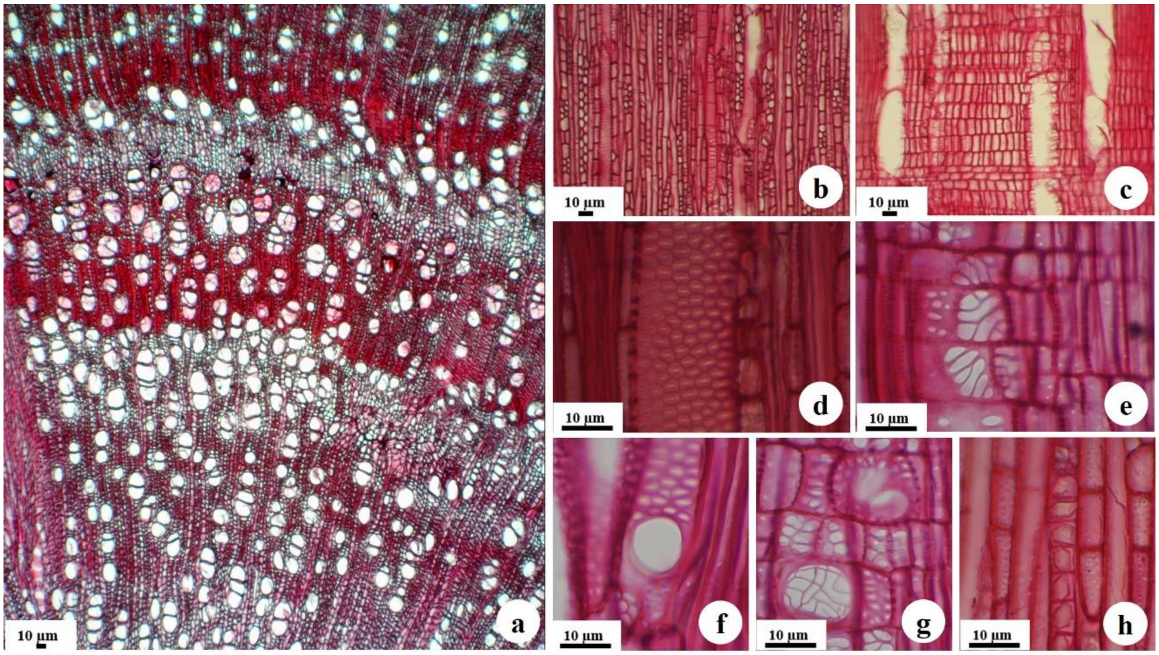

Fig. 2. Microscopy of *Caryocar brasiliense* wood. (a) transverse section; (b) tangential section; (c) radial section; (d) intervessel pits; (e) vessel–ray pits; (f) simple perforation plate; (g) Radiate perforation plate. (h) Prismatic crystals.

Growth ring distinct: boundaries marked by different frequency of earlywood and latewood vessels. **Vessels**: wood diffuse porous, with no clear arrangement, solitary vessels (57%), multiples of 2 cells (30%), 3 cells (8%), 4 cells (3%), and 5 or more cells (2%). Vessel frequency 40 (18 to 78) vessels/mm². Perforation plates simple, mean tangential diameter 90.15 (42.13 to 225.10) µm, Vessel elements with a length of 468.04 (238.29 to 740.61) µm, intervessel pits alternate, vessel–ray pits with much reduced borders to apparently simple and of different sizes within the same cell. Tyloses commonly presents. **Axial parenchyma**: diffuse and diffuse-in-aggregates. **Rays**: Rays with multiseriate portions as wide as uniseriate portions; 14 (7 to 23) µm wide, taller than 1 mm with 30 or more cell rows. Heterocellular rays, composed of procumbent, square, and upright cells mixed throughout, 26 (18 to 42) rays per linear millimeter. Perforate ray cells (simple and reticulate perforations) present. **Fibers**: Mean fibre length 1123 (665 to 1553) µm, mean wall thickness 5.2 (1.8 to 7.6) µm; septate fibres present. **Secretory elements**: not observed. **Mineral inclusions**: Prismatic crystals in chambered axial parenchyma cells.

Divergences regarding the delimitation of growth layers in *C. brasiliense* have been observed in the literature, such as the occurrence of discontinuous bands and lines of axial parenchyma (Voigt *et al.* 2010; Sonsin *et al.* 2014) and the presence of fibrous zones (Gonçalves 2010; Sonsin-Oliveira 2010). Regarding axial parenchyma, Voigt (2010) mentions a tendency for a reticulate pattern, while Gonçalves (2010) observes vasicentric parenchyma. Fibers with areolate pits are reported by Gonçalves (2010) and Sonsin *et al.* (2014). There is also a discrepancy regarding the frequency of vessels, ranging from 5 to 20 vessels in Gonçalves (2010) to 13 to 33 vessels/mm² in Sonsin *et al.* (2014).

For the Caryocaraceae family, numerous vessels, simple pit membranes, alternate intervessel pits, diffuse apotracheal parenchyma, uni- and biseriate rays, and heterogeneous characteristics are typical features (Record and Hess 1949; Metcalfe and Chalk 1950). Septate fibers are mentioned by Record and Hess (1949) as occurring in *Caryocar* species.

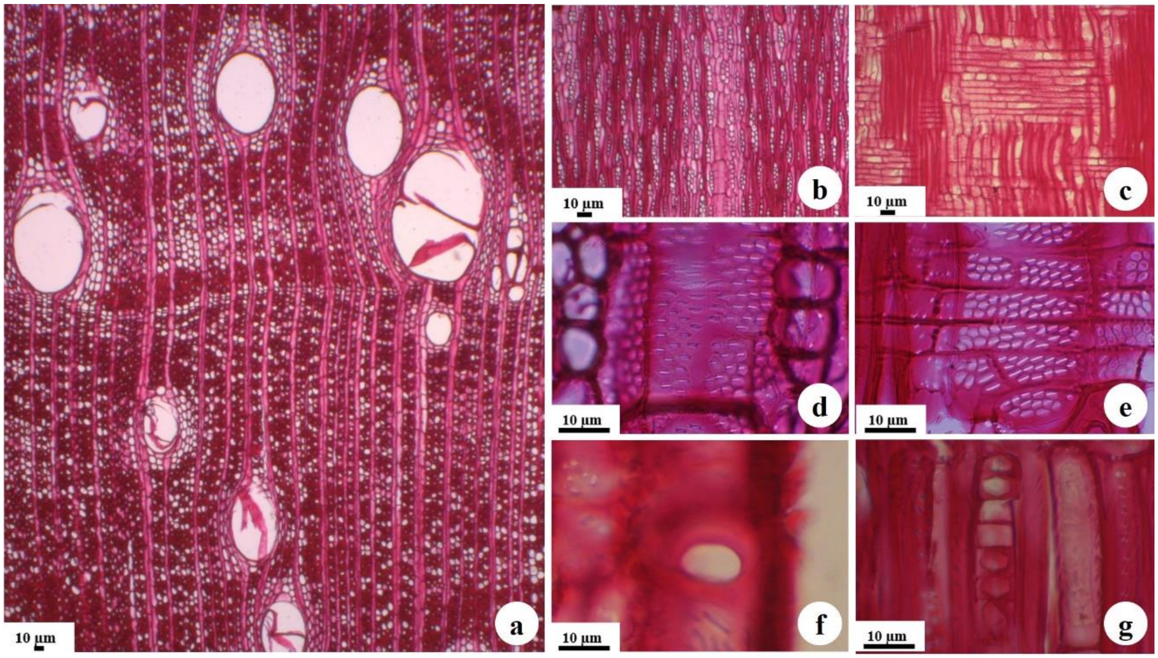

Fig. 3. Microscopy of *Dalbergia miscolobium* wood. (a) transverse section; (b) tangential section; (c) radial section; (d) intervessel pits; (e) vessel–ray pits; (f) simple perforation plate; (g) Prismatic crystals.

Growth rings: poorly delimited, due to the presence of discontinuous lines of axial and subtle decrease in vessel diameter. **Vessels**: wood diffuse porous, with no clear arrangement, predominantly solitary (68%), multiples of 2 cells (18%), of 3 cells (9%), of 4 or more cells (5%), frequency 3 (1 to 6) vessels/mm². Perforation plates simple, two classes of tangential diameter were observed, mean tangential diameter 136.07 (45.94 to 210.78) µm, vessel elements with a length of 213.03 (142.06 to 642.81) µm, intervessel pits alternate and vessel-ray pits similar to intervessel pits in size and shape. **Axial parenchyma**: diffuse-in-aggregates, in lines, vasicentric, lozenge-aliform with short lateral, and with short confluences **Rays**: Ray width 1 to 2 cells; with a width of 32.12 (15.95 to 56.41) µm, consisting of approximately 9 (3 to 22) cells and a height of 188,51 (108.15 to 419.99) µm. The frequency is 8 (3 to 13) rays per linear millimeter. Heterocellular rays, composed of procumbent and square cells. **Fibers**: Mean fibre length 838.49 (460.08 to 1137.32) µm, mean wall thickness 6.53 (2.71 to 9.26) µm; non-septate. **Storied structure**: Rays and axial parenchyma elements irregularly storied. **Secretory elements**: not observed. **Mineral inclusions**: Prismatic crystals in chambered axial parenchyma cells.

Sonsin *et al.* (2014) mention the absence of delimitation of growth layers for the species, while Sonsin-Oliveira (2010) describes the layers as poorly defined, delimited by a fibrous zone. Sonsin-Oliveira (2010) reports the occurrence of reticulated and line-like axial parenchyma. The vasicentric axial parenchyma observed here was not reported by Sonsin *et al.* (2014). Intervessel pits with overarched borders and ray perforated cells are reported by Sonsin *et al.* (2014), which were not observed in this study.

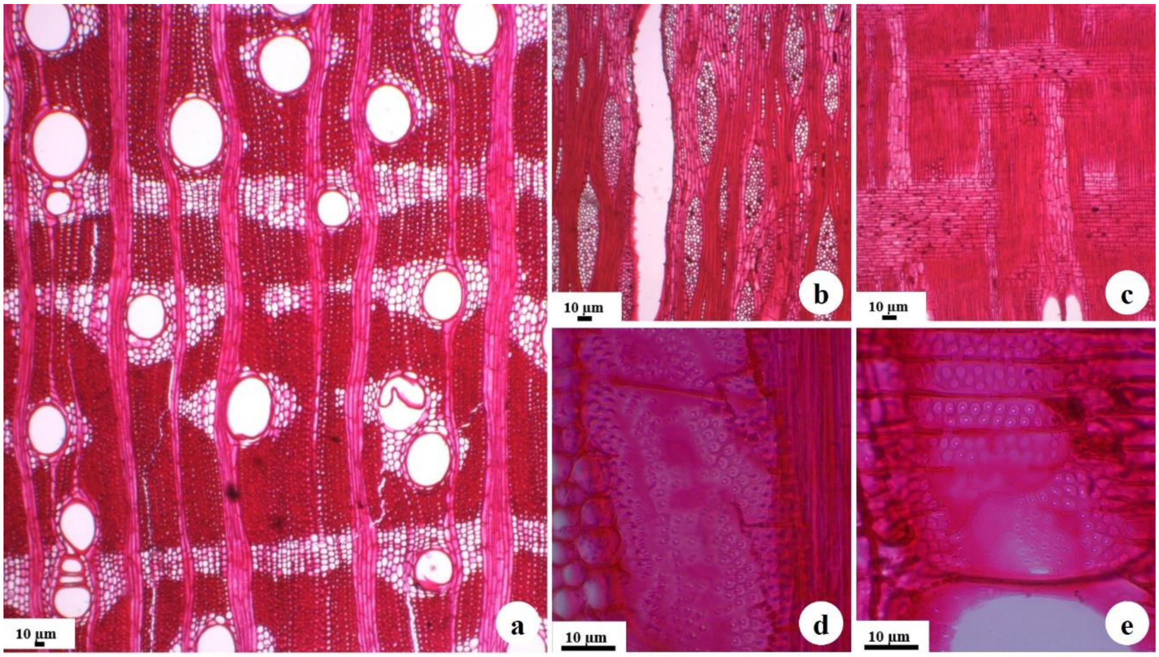

Fig. 4. Microscopy of *Hymenaea stigonocarpa* wood. (a) transverse section; (b) tangential section; (c) radial section; (d) intervessel pits; (e) vessel–ray pits.

Growth ring distinct: marked by marginal parenchyma bands. **Vessels**: wood diffuse porous, with no clear arrangement, predominantly solitary (78%), multiples of 2 cells (15%), of 3 cells (5%), of 4 or more cells (2%) frequency 4 (1 to 8) vessels/mm². Perforation plates simple, mean tangential diameter 150.83 (75.29 to 232.49) µm, vessel elements with a length of 357.31 (195.46 to 549.64) µm, intervessel pits alternate and vessel-ray pits similar to intervessel pits in size and shape. **Axial parenchyma**: Lozenge-aliform with short confluences and marginal. **Rays**: Rays uniseriate and multiseriate, uniseriate with smaller height, multiseriate with 4 (2 to 8) cells and 57.93 (12.57 to 125.92) µm of width, 23 (9 to 49) cells and 394.74 (135.67 to 728.58) µm of height. Heterocellular rays, composed of procumbent cells in the central region and square and upright cells at the margins. The frequency is 5 (2 to 8) rays per linear millimeter. **Fibers**: Mean fibre length 1142.51 (701.31 to 1694.64) µm, mean wall thickness 5.37 (2.30 – 8.98); non-septate. **Secretory elements**: not observed. **Mineral inclusions**: Prismatic crystals in axial parenchyma cells.

The description of the wood anatomy of *H. stigonocarpa* de Mattos *et al.* (2003) very similar to the one found here, except for the finding of organic deposits in the vessels and cellular composition of the rays, described as homogeneous.

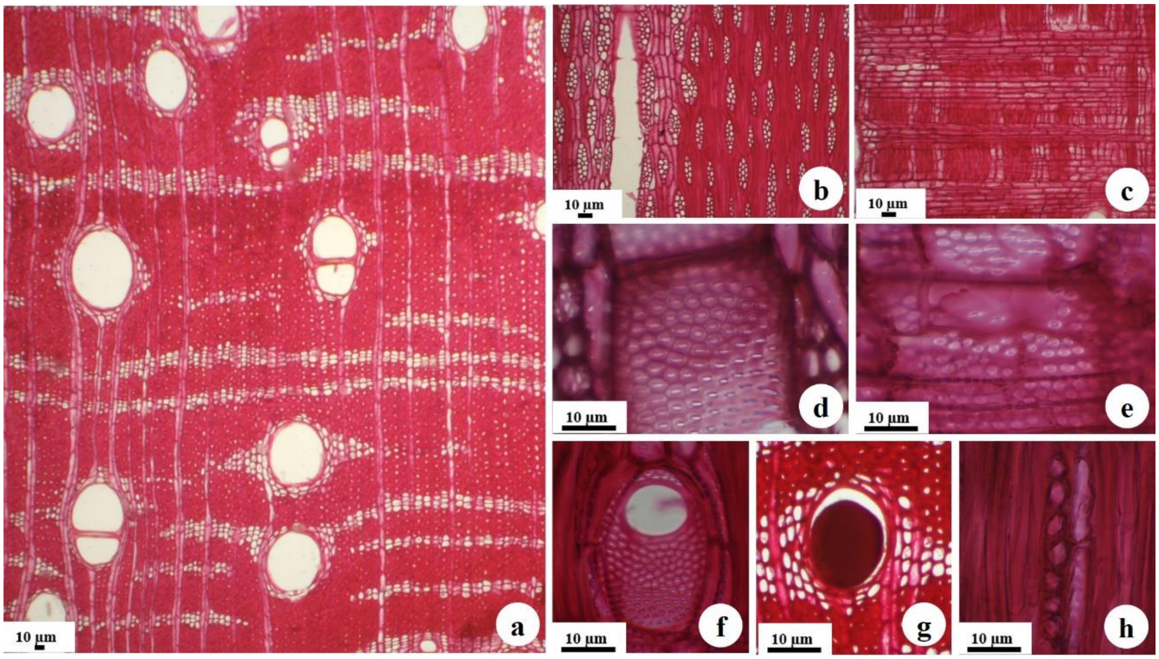

Fig. 5. Microscopy of *Machaerium opacum* wood. (a) transverse section; (b) tangential section; (c) radial section; (d) intervessel pits; (e) vessel–ray pits, (f) simple perforation plate; (g) deposits in vessel, (h) Prismatic crystals.

Growth ring distinct: marked by marginal parenchyma and variation in the distribution of axial parenchyma within the growth layer, from aliform to bands. **Vessels**: wood diffuse porous, with no clear arrangement, predominantly solitary (68%), multiples of 2 cells (19%), of 3 cells (9%), of 4 or more cells (4%), frequency 3 (1 to 8) vessels/mm². Perforation plates simple, mean tangential diameter 105.67 (31.27 to 198.84) µm, vessel elements with a length of 190.17 (128.58 to 275.36) µm, intervessel pits alternate and vessel-ray pits similar to intervessel pits in size and shape. Deposits in vessels observed. **Axial parenchyma**: in bands and lines, lozenge-aliform and winged-aliform confluent, **Rays**: Rays uniseriate and multiseriate. The multiseriate with 2 (2 to 4) cells and 45.66 (15.32 to 99.34) µm in width, 7 (5 to 14) cells and a 171.57 (93.3 to 348.53) µm, of height. Heterocellular rays, composed of procumbent and square cells. The frequency is 9 (3 to 15) rays per linear millimeter. **Fibers**: With 991.68 (614.46 to 1589.98) µm in length and walls of 5.80 (2.71 to 9.39) µm in thickness; non-septate. Storied structure: Rays and axial parenchyma elements storied. **Secretory elements**: not observed. **Mineral inclusions**: Prismatic crystals in chambered axial parenchyma cells.

There are no previous works that describe *Machaerium opacum* wood, indicating a significant lack of studies focusing on the anatomical structure of this species.

The anatomical characteristics observed in *D. miscolobium*, *H. stigonocarpa*, and *M. opacum*, representatives of the Fabaceae family in this study, such as simple pit membranes, alternate intervessel pits, and paratracheal axial parenchyma, are considered characteristic for the family (Baas *et al.* 2000; Wheeler *et al.* 2007). The occurrence of vasicentric axial parenchyma was common among the three Fabaceae species, as also observed by Reis *et al.* (2011). This type of axial parenchyma and its variations are mentioned as characteristics that enable the distinction between species (Metcalfe and Chalk 1950).

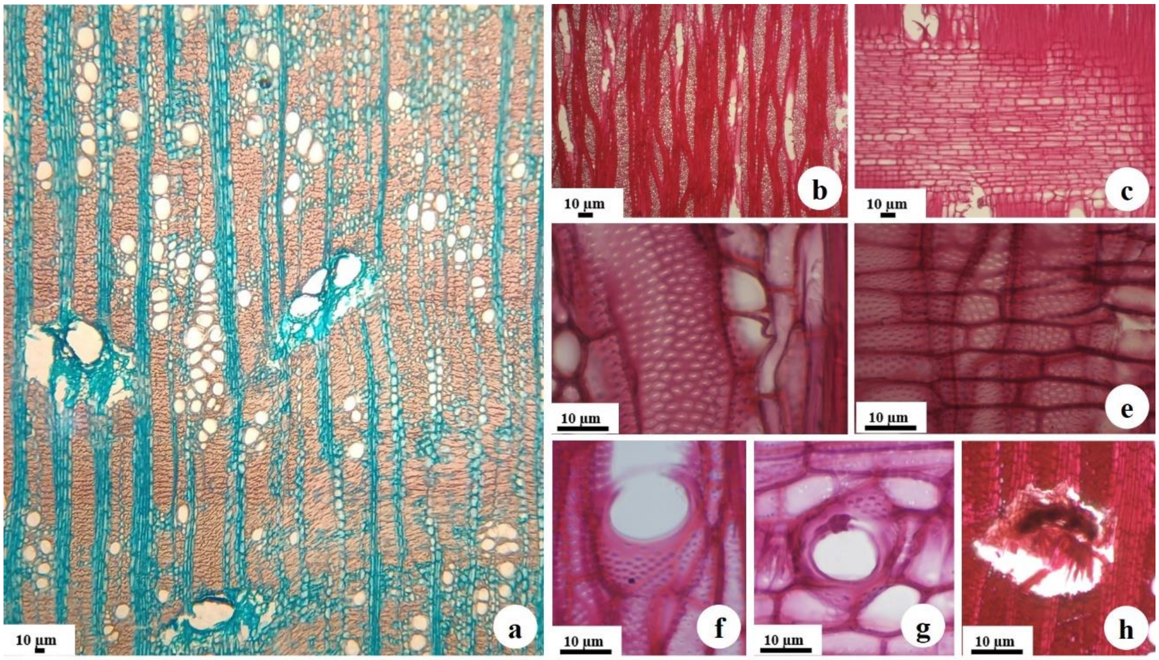

Fig. 6. Microscopy of *Strychnos pseudoquina* wood. (a) transverse section; (b) tangential section; (c) radial section; (d) intervessel pits; (e) vessel–ray pits, (f) simple perforation plate; (g) perforated ray cells, (h) Included phloem.

Growth ring distinct: marked by fibrous zones. **Vessels**: wood diffuse porous, dendritic pattern, predominantly solitary (80%), multiples of 2 cells (15%), of 3 or more cells (5%), frequency 9 (5 to 21) vessels/mm². Perforation plates simple, mean tangential diameter 71.41 (29.99 to 15.69) µm, vessel elements with a length of 329.47 (144.33 to 561.88) µm, intervessel pits alternate and vessel-ray pits similar to intervessel pits in size and shape. **Axial parenchyma**: diffuse, diffuse-in-aggregates, in lines, vasicentric confluent. **Rays**: Rays uniseriate and multiseriate. The multiseriate with 26 (7 to 69) cells and 623.17 (133.95 to 2936.54) µm in width, 6 (3 to 9) cells, and 86.96 (16.91 to 341.49) µm, of height. Heterocellular rays, composed of procumbent and square cells. The frequency is 4 (3 to 6) rays per linear millimeter. Aggregate rays and perforated ray cells presents. **Fibers**: With 1347.33 (800.63 to 1725.37) µm in length and walls of 9.16 (6.20 to 13.01) µm in thickness; non-septate. **Secretory elements**: not observed. **Mineral inclusions**: not observed. **Included phloem**, diffuse.

The descriptions provided by Sonsin *et al.* (2014) and Sonsin-Oliveira (2010) for *S. pseudoquina* are consistent with the findings here, except for the delimitation of growth layers, which is reported as absent (Sonsin *et al.* 2014) or marked by the tangential alignment of interxylary phloem (Sonsin-Oliveira 2010). The occurrence of aliform axial parenchyma is also mentioned (Sonsin *et al*. 2014). The presence of vascular tracheids and the radial to dendritic arrangement of vessels are pointed out by Sonsin *et al.* (2014).

Some of the characteristics observed here are described as typical for Loganiaceae and the genus. Diffuse porosity, simple pit membranes, alternate intervessel pits, and rays composed of 3 to 12 cells wide and heterocellular are common in the family. Tall rays and the occurrence of included phloem are also common in *Strychnos* spp. (Record and Hess 1949; Metcalfe and Chalk 1950).

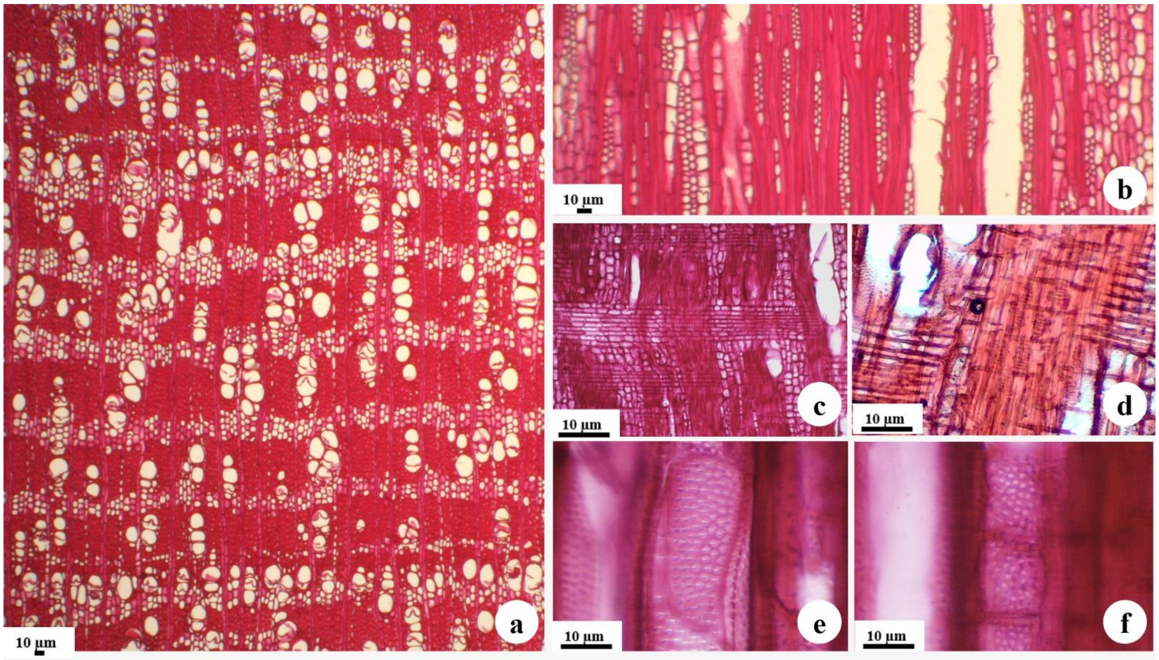

Fig. 7. Microscopy of *Eugenia dysenterica* wood. (a) transverse section; (b) tangential section; (c) radial section; (d) disjunctive radial parenchyma cells walls; (e) intervessel pits, (f) vessel–ray pits.

Growth ring distinct: delimited by tangentially flattened latewood fibers and an increase in vessel frequency. **Vessels**: wood diffuse porous, with no clear arrangement, predominantly solitary (72%), multiples of 2 cells (22%), of 3 cells (4%), of 4 or more cells (2%), frequency 48 (30 to 66) vessels/mm². Perforation plates simple, mean tangential diameter 45.39 (23.77 to 62.83) µm, vessel elements with a length of 474.14 (256.05 to 684.88) µm, intervessel pits alternate and vessel-ray pits similar to intervessel pits in size and shape. **Axial parenchyma**: in bands, diffuse-in-aggregates forming irregular lines, **Rays**: Ray width 1 to 2 cells; with a width of 37.89 (4.22 to 96.11) µm, consisting of approximately 16 (5 to 35) cells and a height of 365.90 (135.21 to 904.49) µm. The frequency is 8 (4 to 11) rays per linear millimeter. Heterocellular rays, composed of procumbent and square cells. Presence of disjunctive radial parenchyma cells walls **Fibers**: With 1189.78 (424.01 to 1618.53) µm in length and walls 6.49 (2.97 to 10.25) µm in thickness; non-septate. **Secretory elements**: not observed. **Mineral inclusions**: Prismatic crystals were observed in axial parenchyma and ray cells, as well as the presence of starch in radial cells.

As well as *Machaerium* opacum, there are no previous works that describe *Eugenia dysenterica* wood, indicating a significant lack of studies focusing on the anatomical structure of these species.

E. dysenterica, belonging to the Myrtaceae family, exhibits in its wood structure diffuse porosity, predominantly solitary and small-sized vessels with no clear arrangement, simple pit membranes, alternate intervessel pits, heterocellular rays, and areolate pit markings on fiber walls. These anatomical characteristics align with those attributed to the family (Record and Hess 1949; Metcalfe and Chalk 1950).

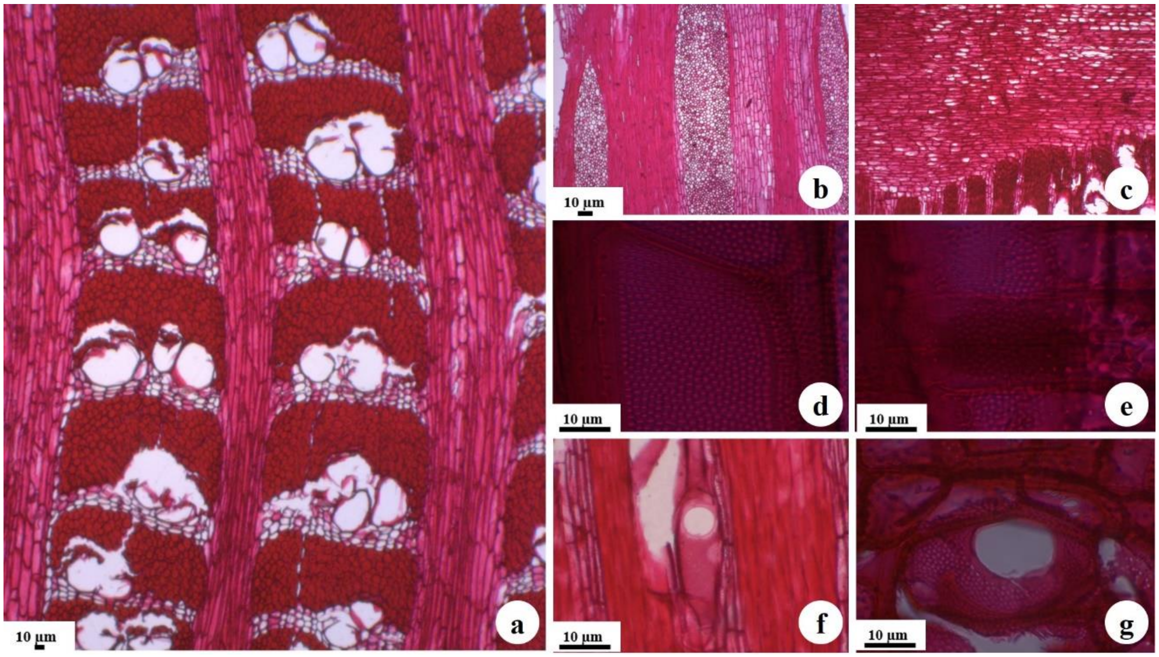

Fig. 8. Microscopy of *Roupala montana* wood. (a) transverse section; (b) tangential section; (c) radial section; (d) intervessel pits; (e) vessel–ray pits, (f) simple perforation plate; (g) perforated ray cells.

Growth ring distinct: delimited by distended rays and closeness of the narrow bands of scalariform parenchyma. **Vessels**: wood diffuse porous, vessels in tangential bands, predominantly solitary (74%), multiples of 2 cells (19%), of 3 cells (7%), frequency 6 (1 to 13) vessels/mm². Perforation plates simple, mean tangential diameter 107.44 (73.91 to 207.41) µm, vessel elements with a length of 505.08 (312.44 to 847.20) µm, intervessel pits alternate and vessel-ray pits similar to intervessel pits in size and shape. **Axial parenchyma**: Scalariform **Rays**: Rays uniseriate and multiseriate. The multiseriate with 17 (8 to 35) cells and 425.71 (194.05 to 813.62) µm in width, with more than 30 cells and exceeding 1 mm in height. Heterocellular rays, composed of procumbent, upright and square cells. The frequency is 1 (1 to 3) rays per linear millimeter. Perforated ray cells presents. **Fibers**: With 1905.61 (801.94 to 2670.02) µm in length and walls of 11.23 (4.43 to 17.17) µm in thickness; non-septate. **Vascular tracheids**: present. **Secretory elements**: not observed. **Mineral inclusions**: not observed.

The anatomical characteristics observed in *R. montana* are consistent with those reported in the consulted literature, except for the indistinct growth layers observed by Soffiatti *et al.* (2016). The diameter of vessel elements and vessel frequency had lower values compared to Sonsin *et al.* (2013), less than 100 µm and 14 to 44 vessels/mm², respectively.

Features such as tangential arrangement of vessels, simple pit membranes, alternate intervessel pits, and similar to vessel-ray pits, axial parenchyma in bands usually associated with vessels, and the occurrence of rays of different sizes observed in *R. montana* in this study are common in the Proteaceae family (Record and Hess 1949; Metcalfe and Chalk 1950).

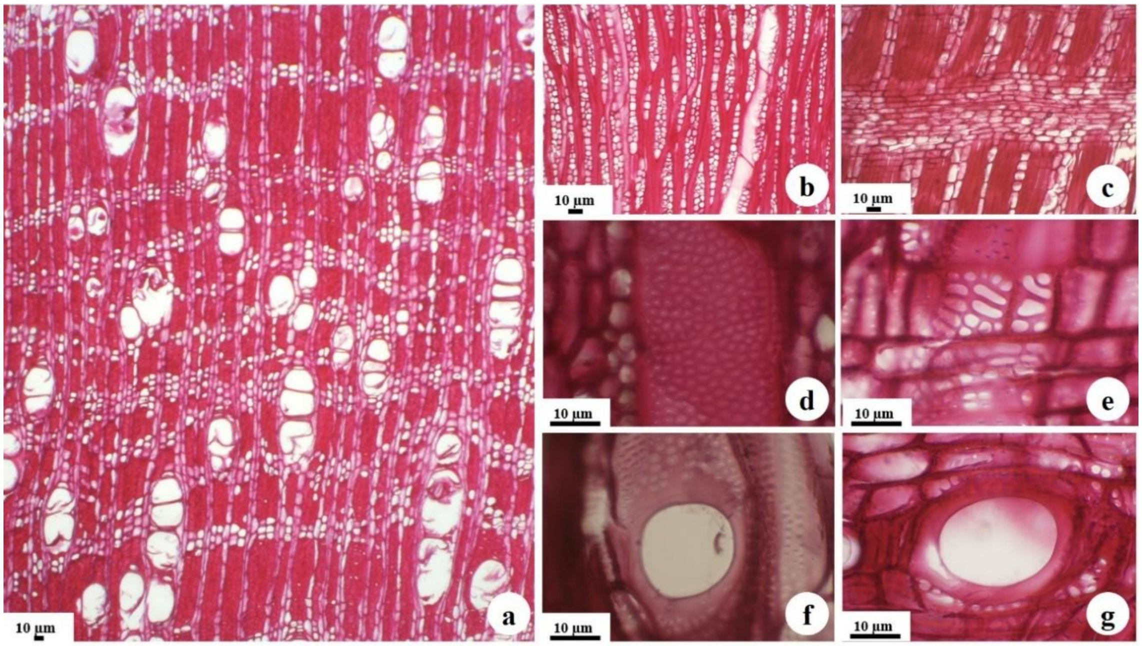

Fig. 9. Microscopy of *Pouteria ramiflora* wood. (a) transverse section; (b) tangential section; (c) radial section; (d) intervessel pits; (e) vessel–ray pits, (f) simple perforation plate; (g) perforated ray cells.

Growth rings: poorly delimited, due to the separation of axial parenchyma bands. **Vessels**: wood diffuse porous, with no clear arrangement, predominantly solitary (57%), multiples of 2 cells (33%), of 3 cells (8%), of 4 cells (2%), frequency 8 (3 to 16) vessels/mm². Perforation plates simple, two classes of tangential diameter were observed, mean tangential diameter 80.05 (25.14 to 141.70), vessel elements with a length of 445.86 (227.19 to 674.51) µm, intervessel pits alternate, vessel–ray pits with much reduced borders to apparently simple and different sizes within the same cell. **Axial parenchyma**: in narrow bands or lines up to three cells wide. **Rays**: Uniseriate, biseriate and rays with multiseriate portions as wide as uniseriate portions, ray with 2 (2 to 4) cells and 37.18 (14.5 to 71.33) µm in width, 16 (5 to 34) cells and 340.32 (148.91 to 819.91) µm, of height. The frequency is 9 (6 to 15) rays per linear millimeter. Heterocellular rays, composed of procumbent cells in the central region and square cells at the margins Perforated ray cells presents. **Fibers**: With 1128.84 (770.32 to 1529.90) µm in length and walls of 8.31 (3.79 to 13.61) µm in thickness; non-septate. **Vascular tracheids**: present. **Secretory elements**: not observed. **Mineral inclusions**: not observed.

The anatomical characteristics observed in *P. ramiflora* correspond to those described by Mattos *et al.* (2003) as well as those described for the genus, except for the predominance of multiple vessels of 2 and 3 over solitary ones (Costa 2006).

Record and Hess (1949) and Metcalfe and Chalk (1950) mention the occurrence of simple pit membranes, alternate intervessel pits distinct from vessel–ray pits, axial parenchyma in bands or reticulate pattern, presence of tracheids, rays composed of 1 to 6 cells in width, and heterocellular rays as common for the Sapotaceae family.

Among the observed characteristics, it was possible to visualize the demarcation of the growth ring for 7 species. However, for two species, the growth layers are poorly demarcated. According to Marcati *et al.* (2006), who studied the growth rings of Cerrado species, growth rings were not discernable in 6% of the species studied, were poorly defined in 33%, and were well defined in 61%.

CONCLUSIONS

1. The microscopic description of wood anatomy of the species occurring in the Cerrado of Minas Gerais provided new information about the wood anatomy of two species, *Machaerium opacum* and *Eugenia dysenterica*, and contributed to the description of other species by adding or corroborating information.
2. Differences found between the descriptions made in this study and those of other works, along with the scarcity of information regarding some species, highlight the need for further research in this line of study to better understand which characteristics are more or less constant among the species, in other words, which characteristics possess distinctive traits.
3. It is recommended to increase the number of described species in order to construct an identification key that will allow for more efficient species identification. The greater the number of species included, the higher the effectiveness and applicability of this tool.

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