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Scientific Article

FIELD DURABILITY OF *Mimosa caesalpiniifolia* AND *Mimosa tenuiflora* WOODS

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ABSTRACT

Using native woods in their original state as posts, fences and contractions is an environmentally and economically friendly initiative, as it reduces the need for wood preservation chemicals. However, each species must be assessed for its natural durability to determine whether it is suitable for such ends. The present work aimed to evaluate the natural durability of round wood pieces of *Mimosa caesalpiniifolia* and *Mimosa tenuiflora* after three years of service in the field and to compare their deterioration levels with those found for non-treated and treated *Eucalyptus* wood with Chromated Copper Arsenate (CCA). Round wood pieces, 1 m long, with an average diameter of 10 to 15 cm, were partially buried in the soil to a depth of half their length in a field experiment. Additionally, test specimens of *M. caesalpiniifolia* and *M. tenuiflora* (30 replicates for each species) were buried using the same experimental design. All wood samples were left in the field for three years and were periodically assessed to determine the extent of deterioration. Both experiments were set according to an entirely randomized block design (RBD). After exposure the deterioration index and decay susceptibility were determined. Experimental data were subjected to analysis of variance, and when significant differences were established, the means were compared using the Tukey test. The results, particularly the decay susceptibility index, showed that *M. caesalpiniifolia* and *M. tenuiflora* performed worse than the reference samples of CCA-treated *Eucalyptus*. However, their performance was similar. These results highlight that both species studied produce durable woods suitable for outdoor use and direct contact with the soil.

Keywords: Wood deterioration, Natural weathering, Field decay test

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DURABILIDADE DAS MADEIRAS DE *Mimosa caesalpiniifolia* E *Mimosa tenuiflora* EM ENSAIOS DE CAMPO

RESUMO A utilização de madeiras nativas como postes, cercas e construções é uma iniciativa economicamente sustentável, devido à redução do uso de produtos químicos utilizados na preservação. Entretanto, cada espécie deve ser avaliada quanto à sua durabilidade natural para verificar se é adequada a tais fins. O presente trabalho teve como objetivo avaliar a durabilidade natural de toras de *Mimosa caesalpiniifolia* e *Mimosa tenuiflora* quando expostas ao serviço por três anos em campo e comparar seus níveis de deterioração com a madeira de *Eucalyptus* tratada e não tratada com Arseniato de Cobre Cromado (CCA). Toras de madeira com 1 m de comprimento e diâmetro médio de 10 a 15 cm foram parcialmente enterradas no solo até a metade de seu comprimento, em um experimento conduzido em campo, com sete repetições para cada tipo de madeira. Adicionalmente, espécimes de teste de *M. caesalpiniifolia* e *M. tenuiflora* foram enterrados seguindo o mesmo padrão experimental. As amostras permaneceram em campo por três anos e foram avaliadas periodicamente para determinar a deterioração. Ambos os experimentos foram conduzidos segundo um delineamento em blocos casualizados (DBC). Foram determinados a perda de massa após a exposição, o índice de deterioração e a suscetibilidade à decomposição. Os dados experimentais foram submetidos à análise de variância e, quando se constataram diferenças significativas, as médias foram comparadas pelo teste de Tukey. O índice de suscetibilidade indicou que as madeiras de *M. caesalpiniifolia* e *M. tenuiflora* apresentaram desempenho inferior ao das amostras de referência de *Eucalyptus* tratadas com CCA. Contudo, o desempenho geral foi semelhante. Esses resultados destacam que ambas as espécies estudadas apresentaram madeiras duráveis, adequadas ao uso em ambientes externos e em contato direto com o solo.

Palavras-Chave: Deterioração da madeira, Intemperismo natural, Campo de apodrecimento

1. INTRODUCTION

Wood-soil contact is one aspect that closely affects the natural durability of this material. It is essential to know the deteriorating agents and identify their main forms of damage so that recommendations can be made regarding the best use of wood based on its properties (Marais et al., 2020). For EN 1001-2, the expression ‘natural durability’ or ‘natural resistance’ is the resistance of wood, which has not undergone treatment, preservation or improvement, to improve its durability (CEN, 2005). Is related to the act of evaluating the time of the wood in service and its susceptibility to decay and deterioration under the action of some agents, whether biotic, such as termites, fungi, bacteria, and marine borers, or abiotic, whether physical, chemical, or mechanical, such as rain, wind, radiation, heat and humidity. Natural durability can also vary depending on the species, geographic origin, age and growth conditions of the wood (Mazela & Popescu, 2017). Thus, wood can present high, medium, or low resistance to the action of these agents.

Therefore, understanding wood's natural durability and susceptibility to biodeterioration agents is more than an academic exercise. It is a crucial aspect of wood science field, and the role as researchers, scientists, and professionals is integral to this understanding (Martín & López, 2023; Carvalho et al., 2015; Arpanaei et al., 2024). The work allows us to observe variations in natural durability between species, anticipate potential damage and losses, and make informed decisions about the rational use of wood. Furthermore, this sort of study allows the prediction of the behavior of a given timber after its exposure to conditions favorable to the appearance of these organisms, the use of preservative chemicals, increasing the integrity of the construction and safety for people, thus avoiding unnecessary expenses with the replacement of deteriorated parts and minimizing the impacts on the remaining forests. Therefore, this studies on the natural durability of native woods are critical (Oliveira et al., 2005; Melo et al., 2010;

Gonçalves et al., 2013; Pillocelli et al., 2015).

Natural resistance of wood to specific attacks by biological agents is mainly due to extractives, which are toxic or repellent to wood-eating organisms. However, extractives can vary widely by species, between trees and within portions of the wood and are usually located mainly in the bark and heartwood, more precisely in the transition region to the sapwood, decreasing towards the pith and increasing towards the base of the trunk. Therefore, the heartwood represents wood's most significant natural durability capacity (Oliveira et al., 2005; Brischke et al., 2013; Hassan et al., 2017; Valette et al., 2017). Laboratory tests with fungi and xylophagous insects are based on exposing wood specimens to fungal and insect cultures for a certain period, which may or may not result in loss of wood mass due to the action of these xylophagous agents. The results are then compared to tabulated values that establish a relationship between the observed mass losses and the subjectively established resistance classes.

Even though laboratory tests allow for clearly defined situations and high reproducibility of biodeterioration caused by wood-eating agents, laboratory methodologies do not reproduce all interactions, synergisms, and antagonisms in field conditions. On the other hand, field tests reliably reproduce natural environmental conditions, in which wood samples are subjected to the elements and soil contact and then evaluated for their degree of post-exposure deterioration. In field tests, wood samples are partially buried, exposed to the elements and to wood-eating agents present in the soil, and are periodically inspected to assess their health status (Costa et al., 2012). Because of this, the results obtained in field tests provide a classification of wood durability, and its use in specific environments may or may not be recommended (Corassa et al., 2014).

The present work aimed to assess the natural durability of *Mimosa caesalpiniifolia* and *Mimosa tenuiflora* woods through a decay field test and compare them with treated and non-treated *Eucalyptus* wood subjected to the same field conditions.

2. MATERIAL AND METHODS

The wood logs employed in this experiment were purchased from local farmers growing *Mimosa caesalpiniifolia* Benth. and *Mimosa tenuiflora* (Willd.) Poir. plantations commercially. Treated and non-treated *Eucalyptus* wood logs purchased in a wood store were employed to compare with *M. caesalpiniifolia* and *M. tenuiflora* wood after both types were exposed to field conditions. The treated logs were impregnated with chromate copper arsenate and are commonly used as fence posts.

The wood decay field is located in the Forest Experimentation area of the Specialized Academic Unit in Agricultural Sciences (UAECIA) of the Federal University of Rio Grande do Norte (UFRN) in Macaíba, Rio Grande do Norte, Brazil. The municipality of Macaíba is located in a transition area between the coast and the interior of Rio Grande do Norte. According to the Köppen-Geiger classification, its climate is Aw, a tropical rainforest climate with a dry summer and a rainy season (Braga et al., 2024). The soil at the experimental site was characterized, and the results are presented in Table 1.

The samples were prepared from round wood pieces measuring 1 m long with an average diameter of 10 to 15 cm (Figure 1A). All samples were identified with numbered metal plates. The samples were buried in the soil to a depth of up to half their length, with a spacing of 1.0 m x 1.0 m, according to the standard IUFRO methodology adapted by Lepage (1970) (Figure 1B).

The experiment was conducted for three years (2020 to 2023), during which annual assessments were carried out, with assessments in the first year at nine months, in the second year at 22 months, and in the third year at 33 months. The inspections were carried out preferably in August, coinciding with the end of the rainy season. Starting with the removal of the soil sample for inspection, and after surface cleaning, a visual assessment was carried out to determine the deterioration index using the subjective scoring criterion suggested by IUFRO (Lepage, 1970) and described in Table 2. Since this is a subjective criterion, the scores were assigned by at least three people.

Table 1. Soil characteristics of the experimental area located in Macaíba, Rio Grande do Norte, Brazil
Tabela 1. Características do solo da área experimental localizado na cidade de Macaíba, Rio Grande do Norte, Brasil

Parameter	Results	Parameter	Results
pH	6.3	Na^+ (mg/dm³)	12.8
CE (dS/m)	> 0.01	Ca^{2+} (cmolc/dm³)	1
MO (g/kg)	4.22	Mg^{2+} (cmolc/dm³)	1.05
N (g/kg)	0.14	Al^{3+} (cmolc/dm³)	0
V (%)	77	H+Al (cmolc/dm³)	0.66
M (%)	0	SB (cmolc/dm³)	2.22
PST	2	t (cmolc/dm³)	2.22
P (mg/dm³)	3.7	CTC (cmolc/dm³)	2.88
K^+ (mg/dm³)	45.7		

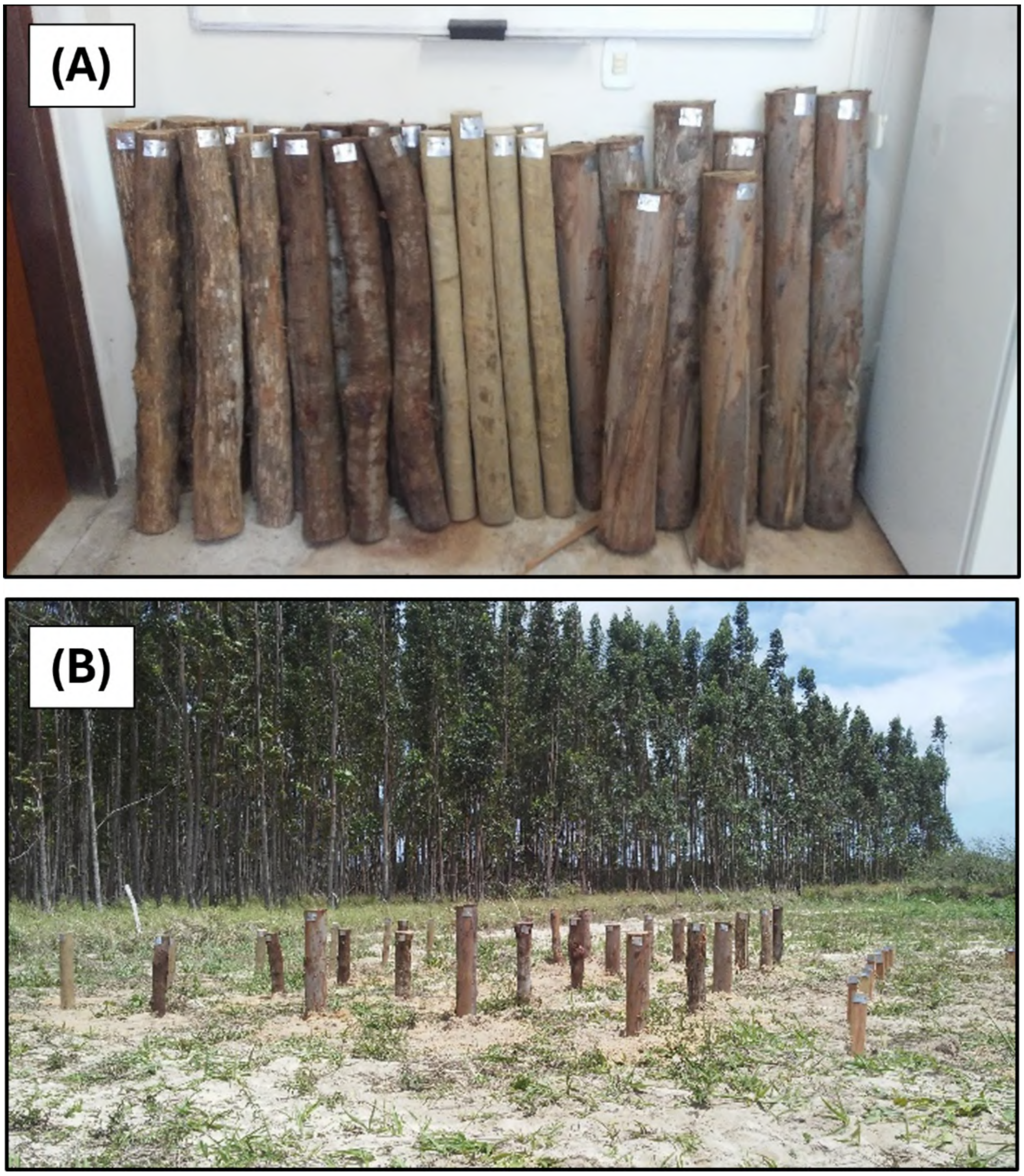

Figure 1. Round wood pieces employed to set the field experiment, *M. caesalpiniifolia, M. tenuiflora*, treated and non-treated *Eucalyptus* wood (A), decay field test at the moment of deploying on October 2020 (B)
Figura 1. Toras de madeira utilizadas no experimento em campo, *M. caesalpiniifolia, M. tenuiflora*, madeira de *Eucalyptus* tratada e não tratada (A), teste de campo de decomposição no momento da instalação em outubro de 2020 (B)

Table 2. Classification of deterioration level of wood in contact with soil
Tabela 2. Classificação do nível de deterioração da madeira em contato com o solo

Sanity State	Score	Deterioration Index (%)
Sound, no attacks detected	0	100
Light or superficial attack by fungi or termites	1	90
Evident but moderate fungal or termite attack	2	70
Intense rot or intense termite attack	3	40
Breakage, almost total loss of resistance	4	0

Source: Lepage (1970).
Fonte: Lepage (1970).

The analyses performed at the time of the evaluation, the following were also observed: (1) the condition of the bark of the samples in percentage, in the aerial part, if adhered, lost, absent, and in the soil if present, (2) the hardness of the wood in the soil and in the aerial part in percentage, by applying light pressure with a screwdriver, (3) the presence of longitudinal cracks in the body of the sample (greater than 5 mm) in percentage, and (4) the presence of termites and fungi (visible presence of fungi structures) (Trevisan et al., 2003).

Furthermore, the samples were evaluated using the Decay Susceptibility Index (DSI) proposed by Curling & Murphy (2002), which relates the mass loss of a given species of interest to that of a reference species. This study used treated round pieces of *Eucalyptus* sp. wood as the reference species for evaluating the DSI. This material is commonly sold in the region as fence posts and stakes. Additionally, *M. caesalpiniifolia* and *M. tenuiflora* slats were assessed to determine the DSI. The log of wood measured 1 m long, with an average diameter of 10 to 15 cm. They were cut from the heartwood of the forest species, exposing the wood's radial, tangential, and longitudinal sections accurately. The slats were buried longitudinally in the ground, so 50% of the specimen was aboveground and the other 50% underground (Figure 2). The DSI used was adapted from the methodology of Curling & Murphy (2002), in which, instead of using mass loss, the deterioration index was calculated using Equation 1.

$$DSI = \frac{\text{(Deterioration index of the species of interest)}}{\text{(Deterioration index of the reference species)}} \quad \text{(Eq. 1)}$$

Where:
DSI = Decay susceptibility Index (%)

The experiment was set up using an entirely randomized block design (RBD), with data on the deterioration index and mass loss assumed to be normally distributed (Shapiro-Wilk). Afterward, they were subjected to analysis of variance and, when significant differences were established, compared using the Tukey test ($p < 0.05$).

3. RESULTS

All woods assessed showed signs of damage during the three-year experiment period. The reference species, treated *Eucalyptus* with Chromated Copper Arsenate (CCA), presented the highest resistance to weathering and the action of abiotic and biotic agents. It offered the lowest deterioration rates throughout the study. On the other hand, the non-treated *Eucalyptus* wood had the highest deterioration rates (Figure 2A). Unlike what was observed for the test specimens, the *M. caesalpiniifolia* wood was less durable in the first year of evaluation than the *M. tenuiflora* wood. This trend continued until the end of the third year.

When analyzing the final exposure time, a significant difference was observed among the species evaluated in the third year of analysis, with *M. caesalpiniifolia* wood exhibiting more intense damage than *M. tenuiflora* (Figure 2B). Despite differences in the deterioration index, no statistical difference was found between the reference species (treated *Eucalyptus* wood), *M. caesalpiniifolia*, and *M. tenuiflora* woods. This fact showed that both native wood species, in their natural condition (without any treatment), exhibited biological resistance to decay, similar to the treated *Eucalyptus* wood (Figure 2B).

The estimated decay susceptibility index (DSI) values for both evaluated species were less than 1.0, indicating that they exhibited more intense wear than the samples used as reference (treated *Eucalyptus* wood). However, it is worth noting that the values were close to those of the reference wood, especially for *M. caesalpiniifolia*, which achieved a DSI of 0.84 after three years of exposure in the field (Figure 3A).

Table 3 shows additional information on the wear of the samples collected in the second year of exposure in the rotting field.

No termites were observed during the analyses. Regarding fungi, only the visible presence of basidiocarps of decay fungi (Basidiomycetes). was observed over time (Figures 4A and 4B), with treated *Eucalyptus* at 16.7% and *M. caesalpiniifolia* at 14.3% (Table 4).

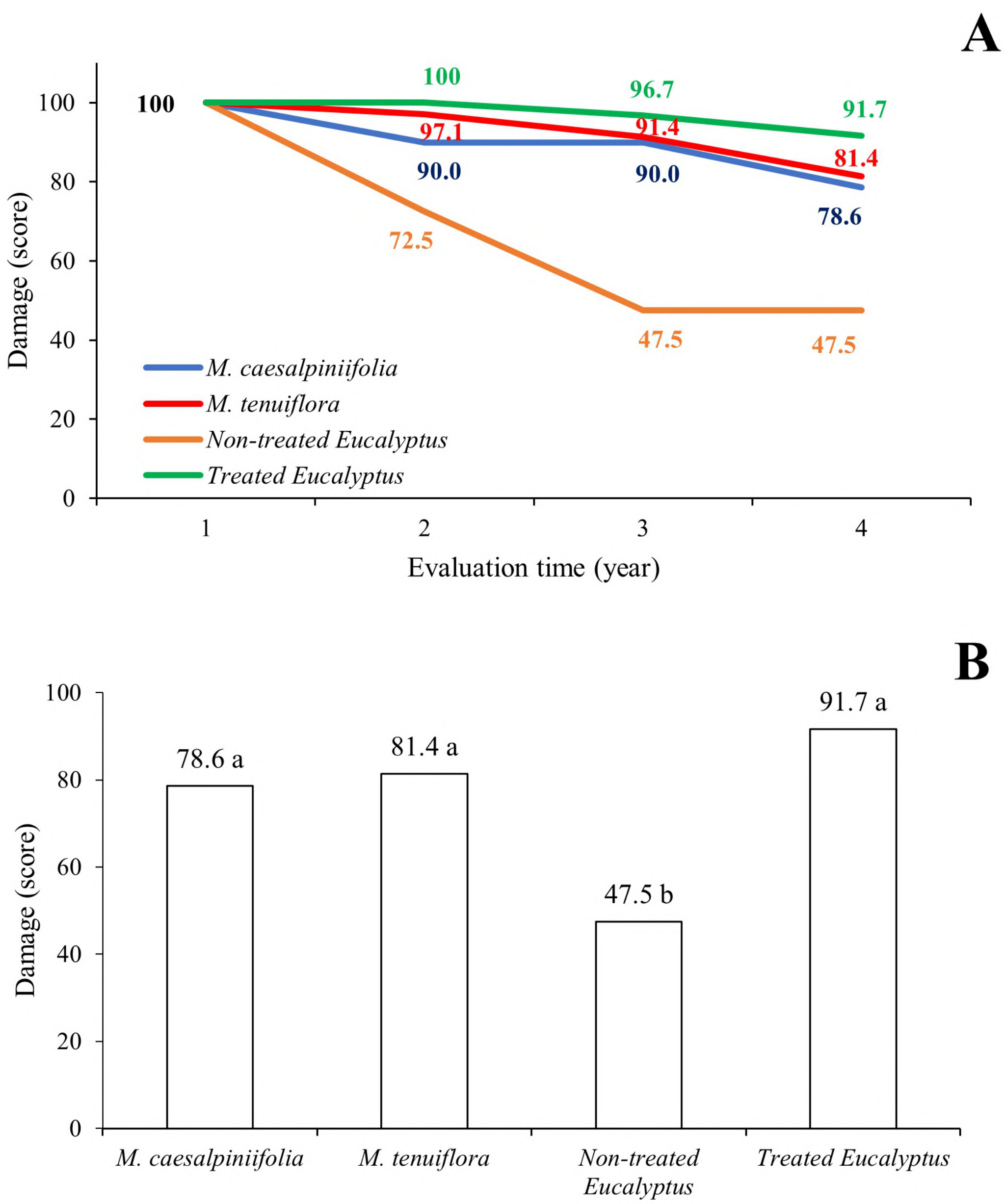

Figure 2. Damage indicator found for *M. caesalpiniifolia, M. tenuiflora*, treated and non-treated *Eucalyptus* woods after three years of exposure in the field – temporal variation (A); analysis after three years of exposure (B)
Figura 2. Indicador de desgaste encontrados para *M. caesalpiniifolia, M. tenuiflora*, madeiras de *Eucalyptus* tratadas e não tratadas após três anos de exposição no campo – variação temporal (A); análise após três anos de exposição (B)

Unlike in the second year of assessment, in the third year, not all samples exhibited satisfactory hardness in the aerial part. In this case, the untreated *Eucalyptus* wood presented only 75% of the samples in good condition. This result is strictly related to the samples' advanced level of damage, where, although the deterioration index remained the same in the last two evaluations, the degradation was visually more advanced. However, not to the point of receiving a score higher than 3, since to receive a score of 4, in addition to losing almost all resistance, there must also be breakage and subsequent removal from the field (Table 5).

Regarding bark condition, its presence on the soil was observed only for *M. tenuiflora* in 71% of the samples. The highest values found for bark attached to the aerial part were 57.1% in the *M. caesalpiniifolia* samples and 14.3% for *M. tenuiflora*. Loose bark was 100% in the untreated *Eucalyptus*

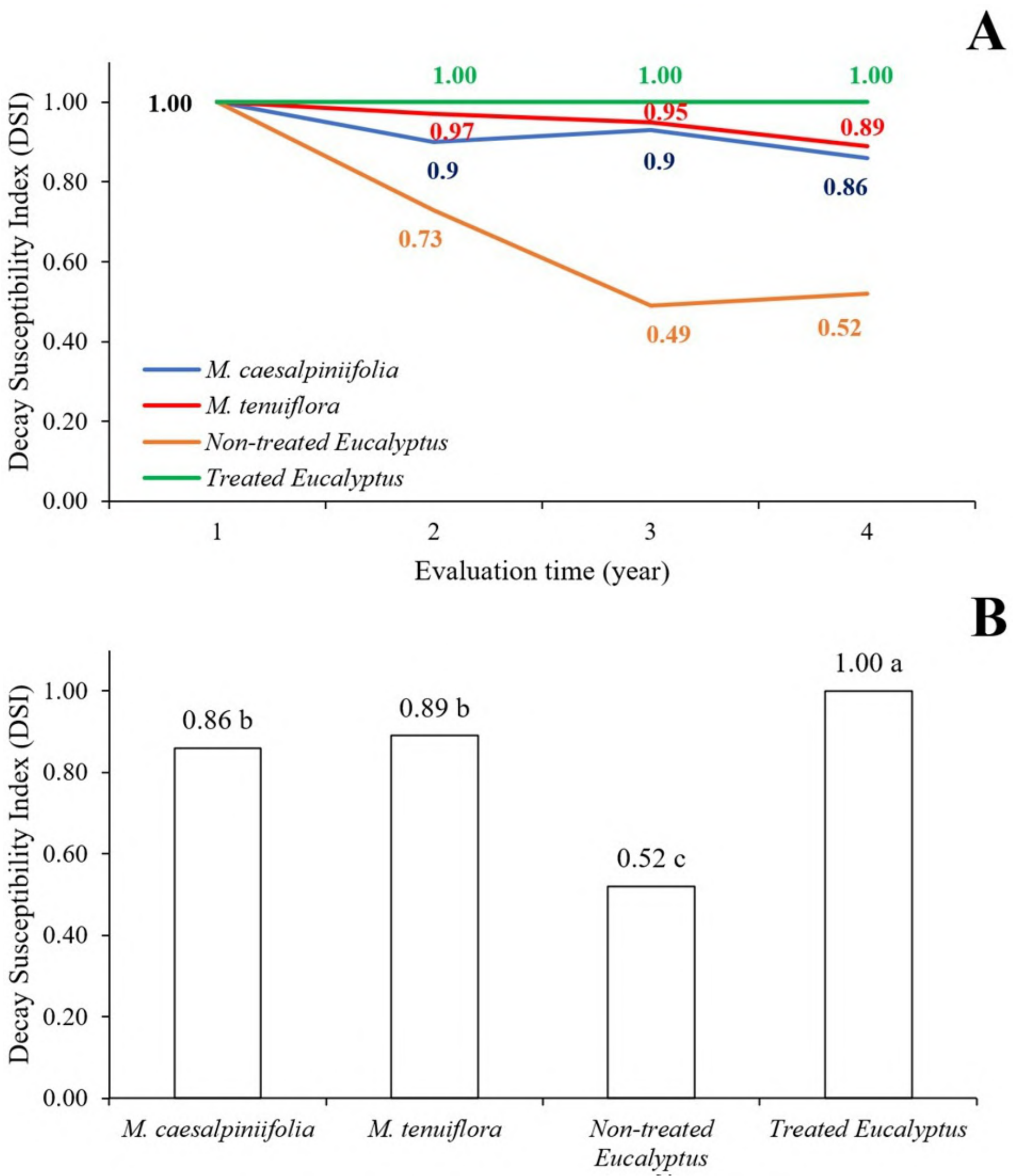

Figure 3. Decay susceptibility index (DSI) determined for *M. caesalpiniifolia, M. tenuiflora*, treated and non-treated *Eucalyptus* woods after three years of exposure in the field – temporal variation (A); analysis after three years of exposure (B)

Figura 3. Índice de suscetibilidade à decomposição (DSI) determinado para *M. caesalpiniifolia, M. tenuiflora*, madeiras de *Eucalyptus* tratadas e não tratadas após três anos de exposição no campo – variação temporal (A); análise após três anos de exposição (B)

Table 3. Deterioration level of the assessed woods, expressed by the bark adhered (%), lose or absent, hardness presence (%), and longitudinal cracks (%) after the second year of exposure in the field
Tabela 3. Nível de deterioração das madeiras avaliadas, expresso pelos percentuais de casca aderida, solta ou ausente, percentagem de amostras com madeira dura e rachaduras longitudinais após o segundo ano de exposição no campo

Round wood pieces	Hardness (%)		Bark aspect (%)		Longitudinal cracks (%)
	Buried	Aerial	Buried	Aerial	
M. caesalpiniifolia	85.7	100.0	0.0	57.1 adhered 42.9 loose	57.0
M. tenuiflora	57.1	100.0	71.0	14.3 adhered 85.7 loose	100.0
Non-treated *Eucalyptus*	0.0	100.0	0.0	100.0 loose	100.0
Treated *Eucalyptus**	100.0	100.0	-	-	0.0

*The treated *Eucalyptus* logs did not have bark.
*As toras de *Eucalytus* tratado não continham casca.

samples, 85.7% in *M. tenuiflora*, and 42.9% in *M. caesalpiniifolia*.

Once again, longitudinal cracks occurred more frequently in round wood pieces, with *M. tenuiflora* and non-treated *Eucalyptus* having the highest rates, with 100% for both, while *M. caesalpiniifolia* had 85.7%. In this experiment, longitudinal cracks were observed in approximately 33.3% of treated *Eucalyptus* round pieces. At the same time, for the test specimens, *M. tenuiflora* samples presented cracks in 18.5% of the samples, and *M. caesalpiniifolia*, 6.1% (Table 6). Regarding the presence of termites,

Figure 4. Presence of fungi (mushrooms) in the round wood pieces of *M. caesalpiniifolia* (A) and treated *Eucalyptus* (B) after two years of exposure in the field
Figura 4. Presença de fungos (cogumelos) em pedaços de madeira roliça de *M. caesalpiniifolia* (A) e *Eucalyptus* tratado (B) após dois anos de exposição no campo

Table 4. Presence of termites and fungi in the wood samples after the second year of exposure in the field
Tabela 4. Presença de cupins e fungos nas amostras de madeira após o segundo ano de exposição em campo

Round wood pieces	Presence of termites (%)	Presence of fungi * (%)
M. caesalpiniifolia	0.0	14.3
M. tenuiflora	0.0	0.0
Non-treated *Eucalyptus*	0.0	0.0
Treated *Eucalyptus*	0.0	16.7

*Expressed as the presence of mushrooms in the wood surface.
*Visível pela presença de cogumelos na superfície da madeira.

Table 5. Deterioration level of the assessed woods, expressed by the bark adhered (%), loose or absent, hardness presence (%), and longitudinal cracks (%) after the third year of exposure in the field
Tabela 5. Nível de deterioração das madeiras avaliadas, expresso pelos percentuais da casca aderida, solta ou ausente, percentagem de amostras com madeira dura e rachaduras longitudinais após o terceiro ano de exposição no campo

Round wood pieces	Hardness (%)		Bark aspect (%)		Longitudinal cracks (%)
	Buried	Aerial	Buried	Aerial	
M. caesalpiniifolia	0.0	100.0	0.0	85.7 loose 14.3 absent	85.7
M. tenuiflora	14.3	100.0	14.3	71.4 solta 28.6 absent	100.0
Non-treated *Eucalyptus*	0.0	75.0	0.0	100.0 absente	100.0
Treated *Eucalyptus*	100.0	100.0	-	-	33.3

Table 6. Presence of termites and fungi in the wood samples after the third year of exposure in the field
Tabela 6. Presença de cupins e fungos nas amostras de madeira após o terceiro ano de exposição em campo

Round wood pieces	Presence of termites (%)	Presence of fungi * (%)
M. caesalpiniifolia	0.0	0.0
M. tenuiflora	42.9	0.0
Non-treated *Eucalyptus*	25.0	0.0
Treated *Eucalyptus*	0.0	0.0

*Expressed as the presence of mushrooms in the wood surface.
*Visível pela presença de cogumelos na superfície da madeira.

they were observed in *M. tenuiflora* and non-treated *Eucalyptus* at 42.9% and 25.0%, respectively. However, the presence of fungi was not observed in this third year of evaluation of the rotting field (Table 5).

In summary, *M. tenuiflora* wood exhibited higher rates of longitudinal cracks, making it more susceptible to attack by wood-eating agents and offering less physical resistance to soil-climatic variations. The *M. caesalpiniifolia* wood showed lower rates of longitudinal cracks, less bark loss, and higher percentages of unscathed hardness, making it less susceptible to attacks by wood-eating agents and offering greater physical resistance to soil-climatic variations. This information may contribute to the use and destination of these woods for a wide range of purposes, and it can be stated that, according to their natural properties, both are durable woods, allowing them to be used as posts, stakes and external constructions.

4. DISCUSSION

According to Goes et al. (2023), the current market for wood preservative treatments carried out in autoclaves using vacuum pressure processes guarantees the durability of the wood for an average of 15 years of service and can reach 20 to 30 years can be depending on the characteristics of the soil, climate, xylophagous organisms present in the region, retention and preservative used. However, it should be noted that, in addition to being expensive, these treatments use toxic chemicals that are not environmentally friendly. Thus, regionally available species that perform well under natural outdoor weathering without preservatives emerge as an excellent alternative with economic and environmental advantages.

Regarding the DSI values, the untreated *Eucalyptus* wood stood out with lower average values, with a tendency to decrease throughout the analyses, highlighting its lower resistance compared to the treated *Eucalyptus* (reference species) (Figure 3B). Furthermore, the *M. tenuiflora* was the native species with the highest average values, less susceptible to deterioration than the *M. caesalpiniifolia* but more susceptible than the reference species in this parameter (DSI >1).

When comparing the DSI of the two species studied, *M. tenuiflora* wood presented higher performance than *M. caesalpiniifolia*. In a similar study, Batista et al. (2022) assessed the same parameter in a natural durability study and found that *M. caesalpiniifolia* had the lowest mean value, with an index of roughly 0.73, indicating greater susceptibility to deterioration compared to CCA-treated *Eucalyptus*. In the same study, *M. tenuiflora* had a mean DSI of 1.12, slightly less vulnerable than treated *Eucalyptus*. The same author emphasizes that the decay susceptibility index (DSI) alone is insufficient to determine the durability of the wood studied in the field. It is necessary to include other parameters, such as mass loss and the deterioration susceptibility index, to better characterize the natural durability of wood in the open field.

Regarding hardness, it was found that the aerial parts of the samples (which were not buried) remained in excellent condition, similar to their condition at the time of installation. On the other hand, the buried part of the samples presented wear, which directly influenced their hardness (Figures 2A and 2B). According to several authors, including Pilloceli et al. (2015) and Batista et al. (2022), this behavior is due to the intense microbiological activity in the immediate soil surrounding the wood.

Part of the bark of the native species (*M. tenuiflora* and *M. caesalpiniifolia*) remained on the upper part of the logs even after the third year of exposure, whereas the *Eucalyptus* logs showed complete loss in the second year (Table 3 and Table 5). In the living tree, the bark protects the wood against excessive drying, attacks by degrading organisms, minor injuries, and climate variations. Thus, according to Trevisan et al. (2003), the presence of bark on the buried part and the condition in the aerial part are not parameters to be considered in isolation for classifying wood durability, but rather should be combined with other aspects that can contribute to understanding its deterioration.

Longitudinal cracks occurred more frequently in round pieces, with *M. tenuiflora* and untreated *Eucalyptus* having the highest rates, 100.0%, and *M. caesalpiniifolia* with 57.0%. Only *M. tenuiflora* wood presented cracks in 11.1% of the samples (Table 3). This behavior is related to the natural drying of wood in the open field, where humidity varies across adjacent regions of a piece. In this case, the aerial part was exposed to the weather, while the buried one was 0.25 m (test specimens) and 0.50 m (round pieces) in the ground. This difference in exposure to humidity led to stresses that ruptured the wood, exceeding its mechanical resistance (Souza et al. 2023).

Although the buried part of the treated *Eucalyptus* samples showed 100% hardness, *M. tenuiflora* also exhibited a hard consistency, though this value was relatively low (14.29%). *M. caesalpiniifolia* stood out compared to *M. tenuiflora*, with 63.64% of its samples in good condition in the buried condition, a value higher than 40.74% found for other species (Table 5). Regarding the bark condition, its presence and integrity in the buried part were observed only for *M. tenuiflora* in 14.29% of the samples. The highest values found for loose bark in the aerial part were 85.71% for *M.*

caesalpiniifolia and 71.43% for *M. tenuiflora*. Concerning the absence of bark, it was 100% for the untreated *Eucalyptus*, 28.6% for *M. tenuiflora*, and 14.3% for *M. caesalpiniifolia*. Thus, it is possible to note that although *M. caesalpiniifolia* presents a high index of loose bark, it had a lower percentage of the absence of bark, which most likely resulted in protection of the innermost portions of the wood against biological agents for a more extended period.

According to Melo et al. (2010), the subjective analysis attributed to scores is the main parameter used to evaluate the durability of wood in field decay tests. However, Batista et al. (2022) pointed out that in addition to visual evaluations of the deterioration index, a second parameter, mechanical test or loss of mass/residual dry mass, should be used to better characterize wood's natural resistance in a field test.

In a similar study, Batista et al. (2022) evaluated the mass loss of the two species under analysis over one year and found results in line with those observed in the study: 10.89% for *M. tenuiflora* and 8.06% for *M. caesalpiniifolia*. According to the classification established by AWPA E30 (2022), based on the mass loss values from the present study, the woods of *M. tenuiflora* and *M. caesalpiniifolia* were categorized as resistant (11 to 24%). However, according to the same classification, Batista et al. (2022) reported both species as highly resistant.

In general, to classify their durability, it is necessary to evaluate the species over a longer period in the decay field, allowing a better understanding of their natural resistance and enabling the designation of other suitable uses for the wood of these species. Furthermore, in his study, Rocha et al. (2015) observed strong potential for applying *M. tenuiflora* wood to the production of Edge-Glued Panels – EGP, due to the diameter and length of the tree trunks. Thus, there may be a significant waste of specific individuals that could be applied to products with higher added value than the energy sector.

The same was found for *M. caesalpiniifolia* since Carvalho (2007) reported the possible uses of its wood, not only in the energy sector but also as a good option for civil construction, whether in the form of forks, props, lintels, timber frames, rafters, stakes, rods or posts. In addition, a company that produces the species encourages the expansion of options for using this wood, in addition to the most common currently, where the company built a deck of sawn *M. caesalpiniifolia* wood, a bridge with stakes and sawn pieces of the species, in addition to a structure called a reciprocal beam or reciprocal structures, a term used in civil construction for a fitting system, without the use of nails or glue. A company in the forest sector recently also reported the wide range of uses in the furniture sector, producing resistant, well-finished furniture (Ymbu Agroflorestal, 2024).

Furthermore, it is worth noting that using naturally resistant wood reduces the handling of chemical products used in the wood treatment process, as is the case with treated *Eucalyptus*, widely used in civil construction for fencing properties, such as stakes and fence posts. In addition, this type of research can encourage studies on silviculture, reforestation, and sustainable forest management of native species. Thus, new studies analyzing wood degradation in the field are increasingly necessary to elucidate such meaningful relationships, since no research guarantees the durability of the wood of these studied species over the long term.

5. CONCLUSION

The woods studied showed variation in natural durability, with *M. tenuiflora* exhibiting superior performance compared with *M. caesalpiniifolia*. The decay susceptibility index used to evaluate the woods' performance indicated that they performed lower than the reference samples of CCA-treated *Eucalyptus*. However, their performance was similar to *M. tenuiflora* in the first two year of the experiment. These results highlight that both species studied produce durable woods suitable for outdoor use and direct contact with the soil.

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AUTHOR CONTRIBUTIONS

Braga, R.S.S.: conceptualization, methodology, investigation, writing—original draft; Canto, J.L.do: methodology, formal analysis, investigation, writing—review and editing, visualization, supervision; Garlet, A.: methodology, validation, formal analysis, investigation, writing—review and editing, visualization; Pimenta, A.S.: conceptualization, validation, formal analysis, resources, data curation, writing—original draft, funding acquisition; Medeiros Neto, P.N.de: software, formal analysis, writing—review and editing; Rusch, F.: software, formal analysis, data curation, writing—review and editing; Melo, R.R.de: conceptualization, software, validation, formal analysis, resources, data curation, writing—original draft, supervision, project administration, funding acquisition.

DATAAVAILABILITY

The entire dataset supporting the findings of this study has been published within the article.

7. REFERENCES

American Wood Protection Association. (2022). AWPA E30-22: *Standard Method for Evaluating Natural Decay Resistance of Woods Using Laboratory Decay Test*s. (Birmingham, AL: AWPA).

Arpanaei, A., Fu, Q., & Singh, T. (2024). Nanotechnology approaches towards biodeterioration-resistant wood: A review. *Journal of Bioresources and Bioproducts, 9*(1), 3–26. https://doi.org/10.1016/j.jobab.2023.09.001

Batista, F. G., Melo, R. R.; Medeiros, D. T., Lopes, P. J. G. & Gatto, D. A. (2022). Natural durability of five tropical wood species in field decay tests. Maderas. *Ciencia y Tecnología, 24*, Article 0451. https://doi.org/10.4067/S0718-221X2022000100451

Braga, R. S. S., Melo, R. R., Pimenta, A. S., Garlet, A., Canto, J. L. & Medeiros Neto, P. N. (2024). Natural Durability of *Mimosa tenuiflora* and *Mimosa caesalpiniaefolia* Woods: Two Species from the Brazilian Dry Forest. *Floresta e Ambiente, 31*(3): e2024011. https://doi.org/10.1590/2179-8087-FLORAM-2024-0011

Brischke, C., Meyer, L., Alfredsen, G., Humar, M., Francis, L., Flaete, P. & Larsson-Brelid, P. (2013). Natural durability of timber exposed above ground—A survey. *Drvna Industrija, 64*(2), 113–129. https://doi.org/10.5552/drind.2013.1221

Carvalho, P. E. R. (2007). *Sabiá - Mimosa caesalpiniifolia* (Circular Técnica, 135). Embrapa Florestas. https://www.infoteca.eptc.cnptia.embrapa.br/infoteca/bitstream/doc/304676/1/Circular135.pdf

Carvalho, D. E., Santini, E. J., Gouveia, F. N. & Rocha, M. P. (2015). Natural resistance of four forest species submitted to test with decay fungi. *Floresta e Ambiente, 22*(2), 271–276. https://doi.org/10.1590/2179-8087.105914

European Committee for Standardization. (2005). EN 1001-2: Durability of wood and wood-based products—Part 2: Vocabulary. CEN.

Corassa, J. N., Pires, E. M., Andrade Neto, V. R. & Tariga, T. C. (2014). Termites associated with the degradation of five forest tree species in a decay field. *Floresta e Ambiente, 21*(1), 78–84. https://doi.org/10.4322/floram.2014.014

Costa, A. F., Vale, A. T., Gonzalez, J. C. & Souza, F. D. M. (2012). Durability of treated and non-treated woods in field test. *Floresta e Ambiente, 19*(1), 7–14.

Curling, S. F., & Murphy, R. J. (2002). The use of the Decay Susceptibility Index (DSI) in the evaluation of biological durability tests of wood based board materials. *Holz als Roh- und Werkstoff, 60*(3), 224–226. https://doi.org/10.1007/s00107-002-0284-2

Goes, M. B., Vale, C. M., & Paula, G. D. (2023). A madeira roliça de eucalipto como solução estrutural e construtiva. *Revista Científica Multidisciplinar Núcleo do Conhecimento, 4*(4), e443006. https://doi.org/10.47820/recima21.v4i4.3006

Gonçalves, F. G., Pinheiro, D. T. C., Paes, J. B., Carvalho, A. G., Oliceira, G. L. (2013). Natural durability of wood forest species to dry-wood termite attack. *Floresta e Ambiente, 20*(1), 110–116. https://doi.org/10.4322/floram.2012.063

Hassan, B., Mankowski, M. E., Kirker, G. & Ahmed, S. (2017). Effects of heartwood extractives on symbiotic protozoan communities and mortality in two termite species. *International Biodeterioration & Biodegradation, 123*, 27–36. https://doi.org/10.1016/j.ibiod.2017.05.023

Lepage, E. S. (1970). Método padrão sugerido pela IUFRO para ensaios de campo com estacas de madeira. *Preservação de Madeiras, 1*(4), 205–216.

Marais, B. N., Brischke, C., & Militz, H. (2020). Wood durability in terrestrial and aquatic environments—A review of biotic and abiotic influence factors. *Wood Material Science & Engineering, 17*(2), 82–105. https://doi.org/10.1080/17480272.2020.1779810

Martín, J. A., & López, R. (2023). Biological deterioration and natural durability of wood in Europe. *Forests, 14*(2), Article 283. https://doi.org/10.3390/f14020283

Mazela, B., & Popescu, C.-M. (2017). Solid wood. In D. Jones & C. Brischke (Eds.), *Performance of bio-based building materials* (pp. 22–39). Woodhead Publishing. https://doi.org/10.1016/B978-0-08-100983-9.00002-2

Melo, R. R., Stangerlin, D. M., Santini, E. J., Haselein, C. R., Gatto, D. A., Susin, F. (2010). Natural durability of three wood species in field tests. *Ciência Florestal, 20*(2), 357–365. https://doi.org/10.5902/198050981858

Oliveira, J. T. S., Souza, L. C., Della Lucia, R. M., Souza Jr, W. P. (2005). Influence of extracts in decay resistance of six wood species. *Revista Árvore, 29*(5), 819–826. https://doi.org/10.1590/S0100-67622005000500017

Pilocelli, A., Stangerlin, D. M., Pereira, R. L., Gatto, D. A., Calegari, L. C., Pariz, E., Susin, F. (2015). Natural resistance of cumaru, cedrinho and paricá woods exposed to field tests. *Ciência da Madeira, 6*(1), 1–10. https://doi.org/10.12953/2177-6830.v6n1p1-10

Rocha, H. L. S., Paes, J. B., Miná, A. J. S. & Oliveira, E. (2015). Caracterização físico mecânica da madeira de jurema-preta (*Mimosa tenuiflora*) visando seu emprego na indústria moveleira. *Revista Brasileira de Ciências Agrárias, 10*(2), 262–267. https://doi.org/10.5039/agraria.v10i2a3772

Souza, L. V., Stangerlin, D. M., Melo, R. R., Oliveira, A. C. & Pimenta, A. S. (2023). Decay resistance and weathering properties of thermally-modified amazon woods – *Parkia pendula* (Willd.) and *Simarouba amara* (Aubl.). *Wood Material Science & Engineering, 19*(2), 327–333. https://doi.org/10.1080/17480272.2023.2242823

Trevisan, H., Nadai, J., Lunz, A. M. & Carvalho, A. G. (2003). Subterranean termites (Isoptera: Rhinotermitidae and Termitidae) occurrence and wood natural durability of five forest species. *Ciência Florestal, 13*(2), 153–158. https://doi.org/10.5902/198050981751

Ymbu Agroflorestal Fazenda Pelada. (2024, February 20). Sabiá, uma boa opção para a construção civil. Ymbu Agroflorestal. https://www.ymbuagroflorestal.com.br/sabia-uma-boa-opcao-para-a-construcao-civil/

Valette, N., Perrot, R., Sormani, R., Gelhaye, E. & Morel-Rouhier, M. (2017). Antifungal activities of wood extractives. *Fungal Biology Reviews, 31*(1), 113–123. https://doi.org/10.1016/j.fbr.2017.01.002