

Natural durability of five amazonian species in two different decay environments

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ABSTRACT: Understanding the natural durability of Amazonian wood species in different deterioration environments is essential to promote their sustainable use and extend their useful life in various applications. The present study evaluated the natural durability of five Amazonian wood species in open field and forest in Sinop, Mato Grosso, Brazil. The species evaluated were *Parkia pendula* (Willd.) Benth. ex Walp (Angelim Saia), *Rauvolfia paraensis* Ducke (Peroba d'Água), *Goupia glabra* Aubl. (Cupiúba), *Aspidosperma populifolium* A. DC. (Peroba-Mica) and *Mezilaurus itauba* (Meisn.) Taub. ex Mez (Itaúba). Two hundred samples were used, 40 of each species. Of these, 10 samples of each species were used to determine the apparent density at 12% humidity and then subjected to mechanical testing to obtain the modulus of elasticity and rupture through compression parallel to the fibers, so that these results could be used for comparison at the end of the weathering process. Another 30 samples of each species were exposed for 415 days in both environments mentioned and evaluated by the breakage test after exposure. Termites were collected for identification. After exposure, the health and resistance to compression parallel to the fibers were evaluated. *Parkia pendula* (0.56 ± 0.02 g/cm³) and *Rauvolfia paraensis* (0.70 ± 0.05 g/cm³) had the lowest densities, while *Aspidosperma populifolium* (0.72 ± 0.02 g/cm³), *Goupia glabra* (0.79 ± 0.03 g/cm³) and *Mezilaurus itauba* (0.80 ± 0.06 g/cm³) had the highest. *Parkia pendula* and *Rauvolfia paraensis* were the least durable in all tests, presenting a health index of 60.10%. In contrast, *Mezilaurus itauba* and *Aspidosperma populifolium* demonstrated the greatest durability, reaching 100%. The environment affected only two species: *Goupia glabra* was more affected in open field, and *Rauvolfia paraensis* in the forest. Only termites of the genus *Nasutitermes* were found, preferring *Parkia pendula* and *Rauvolfia paraensis*. The natural durability of *Aspidosperma populifolium* is statistically equivalent to that of *Mezilaurus itauba*. *Aspidosperma populifolium* and *Mezilaurus itauba* showed the greatest biological resistance to wood-boring termites in both environments analyzed, making them more suitable for areas prone to these insects, while *Parkia pendula* and *Rauvolfia paraensis* showed greater susceptibility to attack by *Nasutitermes* termites, regardless of the environment.

Key words: decay resistance, tropical species, health index.

Durabilidade natural de cinco espécies amazônicas em dois diferentes ambientes de apodrecimento

RESUMO: Compreender a durabilidade natural de espécies de madeira amazônica em diferentes ambientes de deterioração é essencial para promover seu uso sustentável e prolongar a vida útil em diversas aplicações. O presente estudo teve como objetivo avaliar a durabilidade natural de cinco espécies de madeira amazônica em campo aberto e floresta em Sinop, Mato Grosso, Brasil. As espécies avaliadas foram *Parkia pendula* (Willd.) Benth. ex Walp (Angelim Saia), *Rauvolfia paraensis* Ducke (Peroba d'Água), *Goupia glabra* Aubl. (Cupiúba), *Aspidosperma populifolium* A. DC. (Peroba-Mica) e *Mezilaurus itauba* (Meisn.) Taub. ex Mez (Itaúba). Foram utilizadas 200 amostras, com 40 de cada espécie, dessas, 10 amostras de cada espécie foram destinadas à determinação da densidade aparente a 12% de umidade e logo em seguida submetidas ao teste mecânico para obtenção dos módulos de elasticidade e ruptura através da compressão paralela às fibras, para esses resultados servirem de comparativos ao final do intemperismo. Outras 30 amostras de cada espécie foram expostas por 415 dias em ambos os ambientes mencionados e avaliadas pelo teste de quebra após a exposição. Cupins foram coletados para identificação. Após exposição, a sanidade e a resistência à compressão paralela às fibras foram avaliadas. *Parkia pendula* ($0,56 \pm 0,02$ g/cm³) e *Rauvolfia paraensis* ($0,70 \pm 0,05$ g/cm³) tiveram as menores densidades, enquanto *Aspidosperma populifolium* ($0,72 \pm 0,02$ g/cm³), *Goupia glabra* ($0,79 \pm 0,03$ g/cm³) e *Mezilaurus itauba* ($0,80 \pm 0,06$ g/cm³) tiveram as maiores. *Parkia pendula* e *Rauvolfia paraensis* foram as menos duráveis em todos os testes, apresentando um índice de sanidade de 60, 10%. Em contrapartida, *Mezilaurus itauba* e *Aspidosperma populifolium* demonstraram a maior durabilidade, alcançando 100%. O ambiente afetou apenas duas espécies: *Goupia glabra* foi mais afetada em campo aberto, e *Rauvolfia paraensis* na mata. Apenas cupins do gênero *Nasutitermes* foram encontrados, preferindo *Parkia pendula* e *Rauvolfia paraensis*. A durabilidade natural da *Aspidosperma populifolium* é estatisticamente equivalente à da *Mezilaurus itauba*. A *Aspidosperma populifolium* e a *Mezilaurus itauba* mostraram a maior resistência biológica a cupins xilófagos em ambos os ambientes analisados, tornando-as mais adequadas para áreas propensas a esses insetos, enquanto *Parkia pendula* e *Rauvolfia paraensis* apresentaram maior suscetibilidade ao ataque de cupins *Nasutitermes*, independentemente do ambiente.

Palavras-chave: resistência à deterioração, espécies tropicais, Índice de sanidade.

INTRODUCTION

Wood, as the most abundant natural polymer on the planet, has been used by humans since the dawn of civilization. It plays a central role in meeting various needs, from building shelters and homes to supporting locomotion and transportation. In addition to its functional utility, wood also stands out as a raw material for creating everyday utensils, while its aesthetic and artistic qualities make it a valuable choice in various visual and creative appreciations (MAKARONA et al., 2017).

In 2022, Brazil recorded a significant production of roundwood, totaling approximately 9.4 million m³ through logging, generating an estimated revenue of around R\$ 6.2 billion, according to data from the Brazilian Institute of Geography and Statistics (IBGE) for 2022. The majority of this production was concentrated in the Legal Amazon, with the states of Pará and Mato Grosso accounting for 71.4% of national production. These figures underscore the importance of the Amazon region to the national timber market (SIDRA - IBGE, 2022).

The Amazonian native woods most used in outdoor environments, such as decks, beams, and exposed structures, are *Mezilaurus itauba* (Meisn.) Taub. ex Mez (Itaúba), *Dipteryx odorata* (Aubl.) Willd. (Cumaru), *Manilkara huberi* (Ducke) A. Chev. (Massaranduba), and *Dinizia excelsa* Ducke (Angelim Vermelho). These species are renowned for their exceptional resistance to moisture, termites, and fungi, which are essential characteristics in tropical regions. Additionally, the wood of certain forest species plays a significant role as an economic product at the national level due to its wide range of applications.

For example, species such as *Mezilaurus itauba* (Meisn.) Taub. ex Mez (Itaúba) are frequently used in structural beams and roofs, while *Goupia glabra* Aubl. (Cupiúba) is commonly used in finishing parts that require resistance and in furniture. *Aspidosperma populifolium* A. DC (Peroba-Mica) and *Rauvolfia paraensis* Ducke (Peroba d'Água) are preferably used in external works and civil construction, while *Parkia pendula* (Willd.) Benth. ex Walp (Angelim Saia) is valued in the manufacture of furniture and light civil construction (Instituto de Pesquisas Tecnológicas - IPT, 2019; FSC, 2024).

In various wood applications, natural durability is an essential characteristic. Forest species that exhibit high resistance to biodeterioration eliminate the need for chemicals to prolong their lifespan, thereby reducing environmental impacts

and the costs associated with replacing parts. This ensures the integrity of civil constructions and the safety of the people using them for a longer period (STALLBAUN et al., 2017).

Several deteriorating agents negatively impact the durability of wood, including high humidity, which facilitates decomposition processes associated with the action of wood-decay fungi (CRUZ, 2001). Sun exposure contributes to structural weakening through moisture loss, resulting in cracks (PAES et al., 2013). Additionally, termites, notable for their wood-eating capability and accelerated reproduction, represent a significant threat, causing substantial economic damage (PAES et al., 2007). In the Amazon region, climatic conditions and soil characteristics are particularly conducive to the development of subterranean termites, which show a preference for deteriorating dry wood (CORASSA et al., 2013). This context highlights the importance of specific preservation and wood management strategies in this region, considering the prevalence of these deteriorating agents and their direct influence on the material's durability.

Understanding wood durability against decay organisms is vital for its effective use, particularly in furniture and construction (ABRUZZI et al., 2012). The wood's resistance is closely tied to its application, emphasizing the need for field deterioration tests. These tests yield critical data on the material's natural durability, guiding its suitability for outdoor use (MATTOS et al., 2013). This evidence-based approach ensures informed wood selection, enhancing the sustainability and efficiency of projects.

In this context, the objective of this study was to evaluate the natural durability of wood from five native Amazonian species: *Parkia pendula*, *Rauvolfia paraensis*, *Goupia glabra*, *Aspidosperma populifolium*, and *Mezilaurus itauba*. The investigation was conducted through deterioration tests in open field and forest environments over a period of 415 days in Sinop, Mato Grosso, Brazil, aiming to determine the resistance of these species to the typical environmental conditions of the region.

MATERIALS AND METHODS

Characterization of the study area

The experiment was conducted in the experimental area of the Universidade Federal do Mato Grosso (UFMT), Sinop campus, located at latitude -11.98°S, longitude -55.56°W, and an altitude of 371 meters, from October 2018 to November

2019. The climate of the region is Aw, hot and humid tropical, according to the Köppen classification, with a rainy season from October to April and a dry season from May to September (SOUZA et al., 2013). The average monthly temperature ranges from 24.9 to 27.7 °C, the average monthly relative humidity varies from 52% to 86%, and the average annual precipitation depth is 1,945 mm, with more than 1,700 mm concentrated in the spring and summer seasons. The detailed information regarding the year in which the study was conducted is presented in figure 1.

Sample collection and preparation

The woods used were *Rauvolfia paraensis*, *Goupia glabra*, *Aspidosperma populifolium*, *Parkia pendula*, and *Mezilaurus itauba*, collected from timber companies in Sinop - MT. For each species, heartwood specimens free of defects were prepared with dimensions of 5 x 5 x 40 cm (thickness, width and length). After drying in an oven at 70 °C until reaching constant weight, the volume and dry mass of each sample were determined. These data were used to calculate the specific mass and, subsequently to calculate the mass loss of the samples subjected to the field test.

In total, 200 samples were used, with 150 used for the field test and 50 kept in the laboratory for determining apparent density based on NBR 7190:1997. The latter served as controls for comparing mechanical tests after weathering. The control samples were reduced to a length of 20 cm. They were taken to the mechanical testing room,

where a Time Group INC. universal testing machine, Model WDW-300E, with a maximum capacity of 300 kN (30 tons) and an accuracy of 1% of the read value was used. Following the ASTM D143-94 (1994) standards to perform the compression test parallel to the grain, and subsequently, obtain the modulus of elasticity and the modulus of rupture of each sample for comparison at the end of the field experiment.

Decay field installation

The samples were subjected to two deterioration environments: in the understory of a native forest fragment in the region, and in an open field without any ground cover vegetation. For sample distribution, the methodology used was adapted from RIBEIRO et al. (2014), where each deterioration environment was defined with five randomized blocks spaced 50 cm apart. Within each block, 15 samples were distributed (three of each species, thus forming one replication per species per block, totaling 5 replications per species in each of the 2 environments), buried to half their length, spaced 20 cm apart, and exposed to biotic and abiotic weathering (Figure 2)

Sample collection and evaluation

After the specimens were installed, termite collections were conducted every 15 days using a brush for identification, over a period of 12 months. After 415 days, a breakage test was performed as proposed by TREVISAN et al. (2008). This involved gently applying circular motion with the hand on

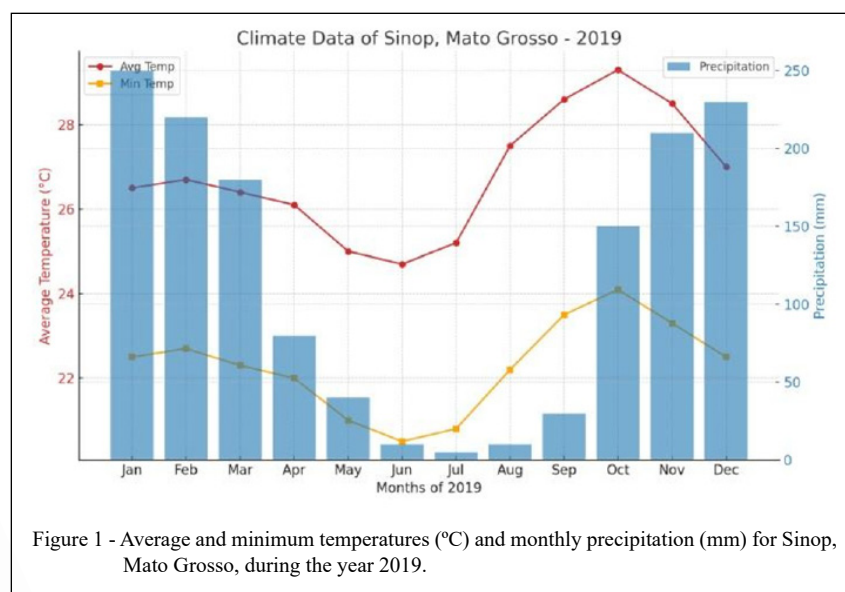


Figure 1 - Average and minimum temperatures (°C) and monthly precipitation (mm) for Sinop, Mato Grosso, during the year 2019.

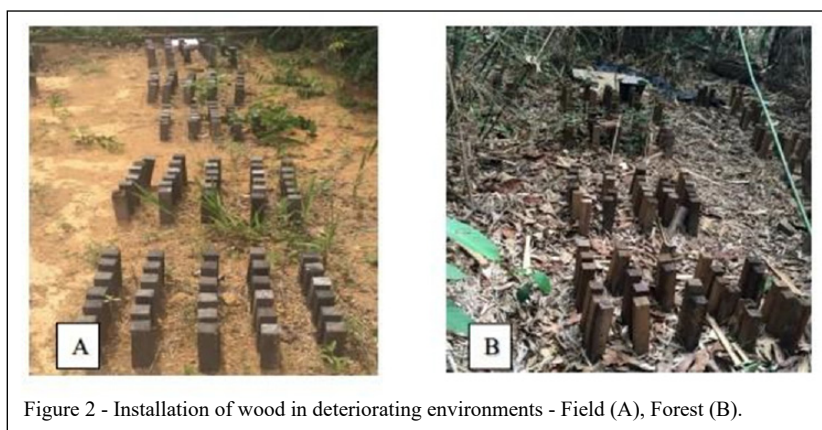


Figure 2 - Installation of wood in deteriorating environments - Field (A), Forest (B).

the aboveground part of the sample while still in the ground, to check if its strength had been reduced to the point of breaking. Once removed from the ground, the samples were cleaned with a brush, weighed to obtain dry mass at 70 °C, and assessed for wood decay by xylophagous organisms using a subjective grading system suggested by LEPAGE (1970), as presented in table 1.

Subsequently, the original samples were reduced to 5 x 5 x 20 cm, taking the part in contact with the soil for mechanical strength evaluations using a universal testing machine following ASTM D143-94 (1994) standards for parallel-to-grain compression testing, obtaining the modulus of rupture (MOR) and modulus of elasticity (MOE). Following this, the values were compared with control samples that were not exposed to weathering, and the percentage loss of strength of the samples was determined.

Analysis of results

For statistical analysis, the data were subjected to normality testing (Shapiro-Wilk) and variance homogeneity testing (Bartlett). Meeting the prerequisites of normality and homogeneity, an analysis of variance (ANOVA) was conducted to verify interaction or differences among the studied factors:

forest species (five levels), deterioration environments (two levels), and the interaction between these factors. When significant, treatment means were compared using the Skott-Knott test ($\alpha = 5\%$).

RESULTS AND DISCUSSION

Nasutitermes sp.

Different levels of infestation were observed based on the evaluated forest species, with all specimens affected by *Nasutitermes* termites, the sole genus present in the study. Thus, the analysis of variance indicated differences among the studied species. *Parkia pendula* and *Rauvolfia paraensis* samples stood out with 80% infestation, *Goupia glabra* had 30%, while *Aspidosperma populifolium* and *Mezilaurus itauba* showed 10%. *Nasutitermes* termites, while classified as subterranean termites, are known for constructing above-ground colonies that can host up to 3 million individuals. These colonies can thrive for 40 to 80 years, and worker termites possess the remarkable ability to metamorphose into queens if the original queen dies (PAES et al., 2007; SANTOS et al., 2017). However, when these termites disrupt their environment, they can inflict substantial economic damage by feeding on

Table 1 - Classification of wood sanity index in contact with soil (LEPAGE, 1970).

Sanity status	-----Grades-----	-----Sanity index (%)-----
Healthy, no attack	0	100
Light or superficial attack by fungi or termites	1	90
Evident, yet moderate attack by fungi and termites	2	70
Severe decay or intense termite attack	3	40
Breakage, almost total loss of strength	4	0

furniture, structural components of buildings, and other cellulose-based materials, often necessitating the replacement of individual parts or even entire structures (STALLBAUN et al., 2017).

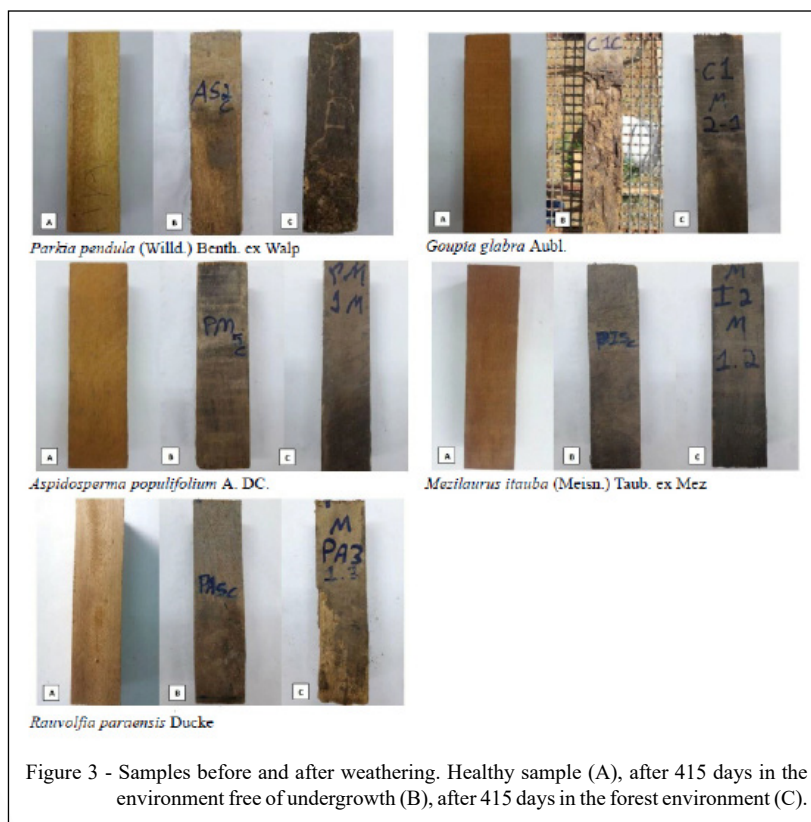
Break test

There were no statistically significant differences observed in the breakage test among the evaluated species. However, *Parkia pendula* stood out with a breakage rate of 13.33% in the open field environment devoid of ground vegetation, indicating greater fragility compared to the other investigated species. The incidence of breakage exclusively in this environment can be attributed to the compacted surface layers of the soil, resulting in a firmer fixation of the samples, which in turn led to breakages when subjected to circular movements. Rigid fixation of wood specimens in the soil during mechanical testing can significantly restrict their ability to absorb mechanical stresses. This limitation increases the likelihood of structural failure when subjected to bending or torsional loads. These considerations are especially crucial for wood species characterized by lower mechanical strength (ARRIAGA et al., 2023; HAFNER et al., 2023).

The distinct behavior of *Parkia pendula* compared to the other species, which did not experience breakage, may be explained by the evident action of termites and fungi (decay agents) observed in the samples exposed to weathering in both mentioned environments, in addition to its low apparent density (0.56 g/cm^3) compared to the other species. Therefore, it is understandable that higher density is associated with greater natural durability in a particular forest species, a critical characteristic for evaluating its potential for use (LOBÃO et al., 2014; BATISTA et al., 2020). Wood species with lower apparent density are generally more vulnerable to biological deterioration, such as fungal decay and termite attack. This susceptibility is linked to the lower resistance of their cellular structure, making them less durable in exposed environments (ARANGO et al., 2016).

Sanity Index

After 415 days of weathering exposure, significant variations were identified in the intensity of termite and decay fungi attacks on the samples of the analyzed forest species (Figure 3). In the open field environment devoid of ground vegetation, it was observed that *Parkia pendula* and *Rauvolfia paraensis*



exhibited the lowest natural durabilities, with health index values of 64.72% and 72.72%, respectively, with no statistically significant difference between them. *Goupia glabra* showed intermediate natural durability, with a health index of 75.38%, while *Aspidosperma populifolium* and *Mezilaurus itauba* displayed the highest natural durabilities, with health index values of 98.68% and 99.34%, respectively, also without statistically significant difference between them, as shown in table 2.

In the forest environment, *Parkia pendula* and *Rauvolfia paraensis* maintained the lowest health index values, both recording 60.10%. Meanwhile, *Goupia glabra*, *Aspidosperma populifolium*, and *Mezilaurus itauba* exhibited higher natural durability, with health index values of 92.02%, 100%, and 100%, respectively, without statistically significant differences among them. Forest species with lower density tend to be more porous, as seen in *Parkia pendula* and *Rauvolfia paraensis*, making them more susceptible to deterioration (LOBÃO et al., 2015). Species with high natural durability, such as *Goupia glabra* and *Aspidosperma populifolium*, often exhibit resistance to biological agents like fungi and termites, maintaining their structural integrity even in adverse environmental conditions. This characteristic is closely linked to their high density and the presence of natural extractives that act as protective agents (LOBÃO et al., 2004).

This result is consistent with a study by ROMANINI et al. (2014), which evaluated the natural durability of four Amazonian species, where Itaúba proved superior when exposed to biotic and abiotic weathering. This outcome can be attributed to its high extractive content (8.21%) and low ash content (0.49%) compared to other species analyzed in the same study.

In a study on the *Parkia* genus, FREIRE & VIANEZ (2014) identified extractive contents

of 5.17% and ash contents of 0.70%. These values contrast with those found by ROMANINI et al. (2014) for *Mezilaurus itauba*, which revealed lower extractive content and higher ash content. This discrepancy may help elucidate the results of the current study, where *Parkia pendula*, also belonging to the *Parkia* genus, exhibited the lowest natural durability compared to the other species investigated.

There is significant evidence to support the claim that Amazonian forest species with high extractive contents, above 7%, tend to exhibit greater natural durability. Several studies indicate that extractive content plays a crucial role in providing resistance against biotic agents such as fungi and insects. For example, studies on species like *Dipteryx odorata* and *Apuleia leiocarpa* show that higher extractive content correlates with greater resistance to xylophagous organisms, contributing to increased durability against decay (SAMPAIO et al., 2024; SABLÍK et al., 2016).

However, it is essential to note that wood resistance isn't solely dependent on extractive content and density. The type of chemical compounds present in the extractives, such as phenolics, also significantly influences the wood's durability. Phenolic compounds, for example, provide biocidal properties that protect wood from microbial and insect attacks, especially under harsh environmental conditions (SAMPAIO et al., 2024; TERRASSE et al., 2021). Therefore, while higher extractive content is a strong indicator of durability, the specific chemical makeup of those extractives is also critical to the wood's resistance. The environment had an impact on the deterioration of *Rauvolfia paraensis* and *Goupia glabra* species, particularly evidenced by the lower sanity index observed in the samples placed in the forest. The behavior of the same wood can vary depending on the exposure environment, as each locality presents specific climatic characteristics

Table 2 - Sanitation Index (%) of the five forest species according to the degradation environment in Sinop - MT.

Species	Apparently density (g/cm ³)	-----Environment-----	
		Free of ground vegetation (%)	Forest (%)
<i>Parkia pendula</i>	0.56 C (± 0.02)	64.72 (± 6.19) Ab	60.10 (± 5.75) Ab
<i>Goupia glabra</i>	0.79 A (± 0.02)	75.38 (± 7.21) Bb	92.02 (± 8.80) Aa
<i>Mezilaurus itauba</i>	0.83 A (± 0.06)	99.34 (± 9.50) Aa	100.00 (± 9.57) Aa
<i>Rauvolfia paraensis</i>	0.70 B (± 0.05)	72.72 (± 5.95) Ab	60.10 (± 4.72) Bb
<i>Aspidosperma populifolium</i>	0.72 B (± 0.03)	98.68 (± 9.44) Aa	100.00 (± 8.82) Aa

Means followed by the same lowercase letter vertically and capital letters horizontally do not differ statistically from each other using the Scott-Knott test at 5%.

and a distinct variety of xylophagous organisms (BATISTA et al., 2020; BATISTA et al., 2022). The greater deterioration of *Rauvolfia paraensis* samples in the forest environment is attributed to the intrinsic characteristics of this forest ecosystem, such as high relative humidity and moderate temperature, which provide favorable conditions for a greater diversity and intensity of xylophagous organism attacks (CORASSA et al., 2013; TREVISAN et al., 2008).

For the *Goupia glabra* species, the environment free of ground cover vegetation had a more significant influence on the deterioration of the samples. This is because this environment is associated with agricultural experiment areas, where the soil is often disturbed with harrows, disrupting the environment and affecting subterranean termite colonies, such as those of the genus *Nasutitermes*, identified in this study (BATISTA et al., 2020). When termites are disturbed due to environmental disturbances, they reproduce rapidly and intensify their attacks, potentially causing economic damage by feeding on furniture, structural components of buildings, and other susceptible materials (STALLBAUN et al., 2017), even species of medium/high density can become susceptible. These results confirmed that the correlation between density and durability is positive, indicating that species with higher apparent density tend to lose less biomass.

Mechanical resistance

The environment did not influence the mechanical strength loss of species. Significant differences were observed only among the species themselves. *Parkia pendula* and *Rauvolfia paraensis* species showed the highest average losses in both Modulus of Elasticity (MOE) - 71.36% and 74.99%, respectively, and Modulus of Rupture (MOR) -

75.26% and 72.75%. In contrast, *Mezilaurus itauba* recorded the lowest average loss, with 37.07% in MOE and 39.40% in MOR. *Goupia glabra* and *Aspidosperma populifolium* species exhibited intermediate loss values for both modules, as indicated in table 3. DIAS JÚNIOR et al. (2013) in a study on *Mezilaurus itauba*, observed that this species, due to its high density and extractive content, presents a lower loss in the Modulus of Elasticity (MOE) and Modulus of Rupture (MOR) compared to other Amazonian species, such as *Parkia pendula*, which presented greater losses in resistance.

These results are consistent with the sanity index data and align with other studies, demonstrating that species with lower sanity index also experience the greatest reductions in both Modulus of Elasticity (MOE) and Modulus of Rupture (MOR) (WEILER et al., 2013).

Exposure of wood to weathering results in the degradation of the cellulose material present in the cell wall, leading to mass loss and consequently, potential reduction in wood elasticity (MATTOS et al., 2013). Moreover, attack by xylophagous organisms degrades wood constituents, affecting its stiffness, durability, and contributing to decreased modulus of rupture and modulus of elasticity in proportion to the increased level of wood degradation due to biotic and abiotic weathering (GATTO et al., 2012; WEILER et al., 2013).

The ABNT NBR 7190 (1997) standard informs that usual average values of resistance and stiffness of species may be related to the density of the species, that is, higher values of resistance properties for wood from species with higher density. This may indicate that this is the reason for the superiority of *Aspidosperma populifolium* and *Mezilaurus itauba* in relation to the other species, the first two being the densest species (OLIVEIRA et al., 2010).

Table 3 - Percentage of Loss in Modulus of Elasticity (MOE) and Modulus of Rupture (MOR) in parallel compression to the fibers of five forest wood species after 415 days of weathering in Sinop - MT.

Species	Loss of Modulus			
	MOE Initial (MPa)	MOE (%)	MOR Initial (MPa)	MOR (%)
<i>Parkia pendula</i>	3724.27 (± 699.29)	71.36 (± 5.52) a	53.66 (± 5.26)	75.26 (± 3.89) a
<i>Goupia glabra</i>	4488.70 (± 785.13)	51.90 (± 10.29) b	63.24 (± 9.15)	56.94 (± 8.20) b
<i>Mezilaurus itauba</i>	4894.71 (± 868.57)	37.07 (± 9.97) c	71.55 (± 9.54)	39.40 (± 10.04) c
<i>Rauvolfia paraensis</i>	5422.62 (± 936.52)	74.99 (± 5.09) a	62.68 (± 9.48)	72.75 (± 5.65) a
<i>Aspidosperma populifolium</i>	5778.41 (± 586.31)	49.05 (± 8.11) b	82.10 (± 6.42)	43.59 (± 5.06) c

Means followed by equal letters (vertical) do not differ statistically from each other by the Scott-Knott test at 5%.

CONCLUSION

In general, it is concluded that among the studied wood species, *Parkia pendula* and *Rauvolfia paraensis* exhibit greater susceptibility to *Nasutitermes* termite attacks regardless of the environment.

Goupia glabra showed intermediate resistance values among the wood species studied in the open field environment. *Aspidosperma populifolium* and *Mezilaurus itauba* exhibited the highest biological resistance to wood-destroying termites in both environments analyzed, making them more suitable for areas prone to these insects, while *Parkia pendula* and *Rauvolfia paraensis* were more susceptible to *Nasutitermes* termite attacks, regardless of the environment.

According to the ABNT standard for mass loss, the species studied have potential for use in civil construction, especially in use for decorations in external constructions, can also be indicated in the use of garden furniture, where direct contact with humidity occurs, however, new studies involving tests in services, evaluating different soil and climate characteristics and longer periods of exposure, would be necessary to confirm such statements.

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DECLARATION OF CONFLICT OF INTEREST

The authors declare no conflict of interest. The founding sponsors had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

AUTHORS' CONTRIBUTIONS

All authors contributed equally for the conception and writing of the manuscript. All authors critically revised the manuscript and approved of the final version.

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