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Research article

Wood consumption preferences in three species of termites (Blattodea, Termitidae) from northeastern Argentina

Preferencias de consumo de madera en tres especies de termitas (Blattodea, Termitidae) del nordeste de Argentina

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ABSTRACT

The consumption behavior of three termite species (*Cortaritermes fulviceps, Nasutitermes aquilinus, and Nasutitermes corniger*) was analyzed through laboratory bioassays, using wood from four tree species commonly utilized in structures and furniture in northeastern Argentina (*Eucalyptus grandis, Pinus elliottii, Neltuma alba*, and *Cordia americana*). Wood consumption by each termite species was measured by the difference between the initial and final dry weight of the samples, and by using a qualitative scale. All four wood types were consumed by the three termite species. The consumption by *C. fulviceps* and *N. aquilinus* was reduced, and the damage was categorized as slight or moderate; therefore, both termites could be considered occasional urban pests. Conversely, *N. corniger* produced the most significant damage in all wood types, confirming its status as a severe structural pest and the need for monitoring and control of this species.

Keywords: Feeding, Isoptera, urban pest.

RESUMEN

Se analizó el comportamiento de consumo de tres especies de termitas (*Cortaritermes fulviceps*, *Nasutitermes aquilinus* y *Nasutitermes corniger*) mediante bioensayos de laboratorio, utilizando maderas de cuatro especies arbóreas comúnmente utilizadas en estructuras y muebles en el noreste argentino (*Eucalypus grandis*, *Pinus elliottii*, *Neltuma alba* y *Cordia americana*). El consumo de madera de cada especie de termita se midió por la diferencia entre el peso seco inicial y final de las muestras, utilizando una escala cualitativa. Los cuatro tipos de madera fueron consumidos por las tres especies de termitas. Los consumos de *C. fulviceps* y *N. aquilinus* fueron reducidos y sus daños se categorizaron como leves o moderados, por lo que ambas termitas podrían considerarse como plagas urbanas ocasionales. Por el contrario, *N. corniger* produjo los daños más importantes en todas las maderas, confirmando el estatus de plaga estructural severa y la necesidad de un monitoreo y control de esta especie.

Palabras Clave: Alimentación, Isoptera, plagas.

INTRODUCTION

The utilization of naturally resistant woods in construction offers significant environmental and economic benefits by reducing the need for chemical treatments and enhancing structural durability. However, the efficacy of such woods is contingent upon their resistance to xylophagous insects, necessitating a thorough understanding of local termite feeding preferences (Arango *et al*., 2006; Paes *et al*., 2015; Cosme *et al*., 2018; Medeiros Neto *et al*., 2022).

Termite feeding behavior is a complex process influenced by a multitude of factors. These include the intrinsic properties of the wood, such as its density, nitrogen content, and the presence of repellent compounds, as well as external factors like humidity and the specific biological traits of the termite species, such as diet, intestinal microbial consortiums, nesting and breeding types (Bustamante and Martius, 1998; Silva *et al*., 2004; Lukmandaru, 2011; Evans *et al*., 2013; Brune, 2014; Ali *et al*., 2021).

Despite extensive research on termite-wood interactions, the applicability of these findings to northeastern Argentina is limited. This is due to the regional variations in termite species and wood types, creating a significant research gap (Paes et al., 2003; Peralta et al., 2004; Arango et al., 2006; Gonçalves and Oliveira, 2006; Peterson and Gerard, 2007; Scholz et al., 2010; Villanueva et al., 2010; Ghosh et al., 2012; Hadi et al., 2012; Gascón-Garrido et al., 2013). Existing studies in Argentina primarily focus on preservative efficacy, leaving the natural resistance of local woods largely unexplored (Armúa et al., 1996; 1997). Given the high prevalence of termite infestations in this region (Torales, 2002; Torales *et al*., 1995; Torales *et al*., 1996), studies on untreated local woods are crucial (Abreu and Silva, 2000; França et al., 2016).

This study specifically examines three prevalent termite species in northeastern Argentina: *Cortaritermes fulviceps* (Silvestri), *Nasutitermes aquilinus* (Holmgren), and the invasive *Nasutitermes corniger* (Motschulsky). These species are known to cause significant structural damage, with *N. corniger* posing a particularly severe threat due to its aggressive nature and rapid spread. (Torales *et al*., 1990; Torales, 1995, 2002; Scheffrahn *et al*., 2005a; Boulogne *et al*., 2017).

The objectives of this research are to determine the consumption rates of four locally used timber species by these termite species and to identify wood species with potential natural resistance. This information will support the selection of durable construction materials, reducing termite-related damages in the region.

MATERIALS AND METHODS

Biological material

Termites used in the bioassays were obtained by collecting five whole nests of each species (*C. fulviceps, N. aquilinus and N. corniger*) from natural and urban environments (Fig. 2a) in the Capital Department, Corrientes province, Argentina (27°29'05"S, 58°46'56"W) during October and November 2019. The nests were removed using a hand axe and shovel and transferred to the laboratory in plastic containers. In the bioterium, each nest was conditioned in a glass container (216 L) on a wet sand basis and no food was supplied for 48 h before each experiment to standardize hunger levels before the bioassay. The colonies were kept in the laboratory at room temperature, which was recorded daily and varied between 22 and 28.6 °C. Relative humidity was also recorded and fluctuated between 57 and 81 %.

Consumption was analyzed in four timbers frequently used in urban structures and furniture in northeastern Argentina, two of them native (*Cordia americana* (L.) and *Neltuma alba* (Griseb.)) and two exotic ones (*Eucalyptus grandis* Hill ex Maide and *Pinus elliottii* (Engelm.)). The main physical characteristics and uses of the selected wood (INTI 2016) are presented in Table 1. Wood pieces of each species (2 x 2 x 10 cm) with smooth surfaces were used to facilitate the observation of the damage caused by termites.

Bioassays

The feeding preferences of the three termite species were evaluated by means of laboratory tests with simultaneous offer of the selected woods for 14 days. The applied methodology corresponded to an adaptation of the proposals of Gazal *et al*. (2010, 2014). A device consisting of

Table 1. Identification, physical characteristics and uses of the woods tested in the bioassays.

Scientific name, common name and family	Apparent density at 15% humidity (g/cm^3)	Janka hardness perpendicular to the fibers	Porosity (%)	Natural durability	Major uses
Cordia americana L. (guayaibí blanco) Boraginaceae	0.800	82.2	46.7	5 - 10 years (outside in contact with the ground)	Parquets, openings, cooperage, etc.
Neltuma alba Griseb. (algarrobo blanco) Leguminosae	0.760	78.5	50.4	10 - 30 years (outside buried)	Furniture, openings, parquet, poles, etc.
Eucalypus grandis Hill ex Maiden (eucalipto) Myrtaceae	0.510	28.62	56	5 - 10 years (outside in contact with the ground)	Floors, furniture, poles, boards, etc.
Pinus elliottii Engelmann (pino) Pinaceae	0.540	31.40	64	5 years (outside in contact with the ground)	Furniture, openings, crates, etc.

a larger vessel containing an entire termite nest connected to a smaller one (4.5 L) through a silicone tube was designed. Before each test, the wood pieces were oven dried at 105 °C for five hours and weighed with a precision balance. After that, they were moistened with distilled water using a sprinkler and placed in the experimental devices. In the smaller container, four blocks of wood (one of each selected wood) were placed, arranged randomly and equidistantly at the point of entry. This design allows, on the one hand, to simulate natural foraging conditions where the nest is separated from food sources, and on the other, to avoid food position bias, which can influence the choice of wood consumed by termites, for example, making them consume more of those located closer to the nest. After the experiments were completed, the pieces of wood were removed from the test vessels and cleaned with a brush to eliminate the remains of the constructions made by termites. Then, the drying and weight recording processes were repeated. Five replicates of the tests were conducted for each termite species.

Data Analysis

Comparative quantitative and qualitative analyses were conducted to obtain a relative indication of wood consumption and feeding preferences for termites. For the quantitative evaluation of feeding preferences, the mass loss of wood samples was determined as an indicator of termite consumption, based on the dry weight before and after each bioassay. The wood consumption data by termites was analyzed using a linear mixed model with the *lme4* package in R, considering termite species (*C. fulviceps*, *N. aquilinus* and *N. corniger*), wood type (*C. americana*, *E. grandis*, *N. alba* and *P. elliottii*), and their interaction as fixed effects, and including hardness as a random effect. The assumptions of normality (Q-Q plots) and homoscedasticity (residuals vs. fitted values) were verified. Statistical significance was evaluated using type III Wald tests (*car* package) with Tukey post-hoc comparisons (*emmeans* , when appropriate. The results were expressed as estimated marginal means with their 95 % confidence intervals, allowing for the evaluation of differences in feeding preferences between termite species and susceptibility between woods. This statistical approach provided a robust basis for identifying both the most vulnerable combinations (combinations of termite species and wood types) and the most resistant forest species in the context of urban pests. Correlations between the physical characteristics of the woods (density, porosity and Janka hardness) and the environmental variables (temperature and relative humidity) with observed intakes were evaluated using the Spearman's correlation coefficient.

The qualitative evaluation of the bioassays was carried out by observing all surfaces of each piece of wood under a stereomicroscope and recording the damages, according to the following criteria, modified from the proposal of Gay *et al*. (1955): 0: without evident signsof attack, 1: slight attack (surface partially eroded or damaged to a depth of less than 3 mm), 2: moderate attack (extensive surface damage or erosion of more than 3 mm depth in some areas), 3: strong attack (considerable damage of more than 3 mm depth with formation of tunnels or cavities, much of the piece consumed). The differences in the qualitative attack levels recorded for each type of wood were analyzed using the chi-square test.

RESULTS

The average mass loss percentages at the end of the bioassays varied significantly among termite species, with *C. fulviceps* showing the lowest consumption (0.333 % to 1.465 %), *N. aquilinus* displaying moderate consumption (0.988 % to 4.128 %), and *N. corniger* showing the highest consumption (10.974 % to 52.610 %) (Table 2). The

Table 2. Dry weights and mass losses of the pieces of wood consumed by *C. fulviceps, N. aquilinus* and *N. corniger* during the bioassays (mean values and standard deviation). References: I: initial weight (g), F: final weight (g), D: weight difference (g), M: mass loss (%).

Termites	Woods	I	F	D	M (%)
C. fulviceps	*P. americana*	27.508 (4.803)	27.104 (5.285)	0.404 (0.736)	1.465
	P. alba	34.206 (2.691)	33.724 (2.888)	0.482 (0.672)	1.409
	E. grandis	26.052 (7.681)	25.850 (7.790)	0.202 (0.247)	0.775
	P. elliottii	24.728 (2.340)	24.648 (2.383)	0.080 (0.085)	0.323
N. aquilinus	*P. americana*	27.834 (4.778)	27.556 (4.722)	0.278 (0.146)	0.998
	P. alba	35.728 (1.522)	35.134 (1.643)	0.594 (0.605)	1.662
	E. grandis	23.778 (1.927)	22.796 (2.873)	0.982 (1.416)	4.128
	P. elliottii	28.328 (5.133)	27.754 (4.823)	0.574 (0.349)	2.026
N. corniger	*P. americana*	26.338 (6.005)	19.120 (10.465)	7.218 (4.632)	27.405
	P. alba	33.714 (4.245)	21.480 (8.756)	12.234 (6.416)	36.287
	E. grandis	26.356 (5.883)	12.490 (12.876)	13.866 (7.874)	52.610
	P. elliottii	29.852 (6.047)	26.576 (8.413)	3.276 (4.339)	10.974

most substantial mass loss was recorded in native woods (*C. americana* and *N. alba*) for *C. fulviceps*, while *N. aquilinus* preferred exotic woods (*E. grandis* and *P. elliottii*). *N. corniger* exhibited a broader range of consumption, with a notable preference for *E. grandis*, where some samples lost over 95 % of their initial mass.

The laboratory bioassays determined that *C. fulviceps*, *N. aquilinus* and *N. corniger* have amplitude in their feeding preferences since the four wood species offered were consumed by the three termites (Fig. 1). None of the presented woods were classified as resistant or unpalatable since all were consumed in one or more of the performed tests.

The analysis of linear mixed models revealed a highly significant interaction between termite species and the evaluated woods ($\chi^2 = 20.33$, $p = 0.0024$). Notably, *N. corniger* showed a higher consumption of *Eucalyptus grandis* compared to the other woods (7.54 ± 3.06 g), being significantly superior to the consumption of *C. fulviceps* (difference = 4.11 g, $p = 0.033$) and *N. aquilinus* (difference = 3.67 g, $p = 0.047$) on the same wood. Furthermore, *N. corniger* exhibited a marked preference for *E. grandis* over *C. americana* (difference = 6.44 g, $p < 0.0001$) and *N. alba* (difference = 4.80 g, $p = 0.0015$).

The consumption records of the three termite species did not show significant correlations with the physical properties of the offered woods (density, porosity and Janka hardness). No precise relationships of these variables with the susceptibility or resistance degree of woods to termite attack have been established so far.

When correlating the environmental variables with the consumption of wood by each termite species, only significant positive values were found for *N. aquilinus* in relation to the relative humidity recorded during the bioassays ($r_s = 0.48$, $p = 0.02$).

The qualitative analysis of the bioassays showed that 48.33 % of the wood pieces had evident signs of termite attack at the end of the experimental period, varying the intensity of the damage from light to strong (Table 3). Although all the woods were visited in the first days of the tests by workers and soldiers of the three species, the workers concentrated the feeding in the woods of their preference after some days, where the frequencies of damages were higher. *C. americana*, *N. alba* and *E. grandis* underwent mild and moderate attacks by *C. fulviceps*, pieces it was not possible to identify affected areas in *P. elliotii* pieces under the stereomicroscope. On the other hand, in the woods offered to *N. aquilinus*, slight damage wasobserved in *C. americana*, mild to moderate damage to *P. elliottii* and moderate damage to *N. alba* and *E. grandis*. *N. corniger* produced the most notable damages, which were moderate to strong inthe four wood types. The differences observed between woods in the frequencies of attack levels according to the qualitative scale were not significant for *C. fulviceps* ($chi^2 = 3.333$; $df = 6$; $p = 0.766$) and *N. aquilinus* ($chi^2 = 6.533$; $df = 6$; $p = 0.366$). For *N. corniger*, on the contrary, significant differences ($chi^2 = 154.872$; $df = 6$; $p < 2.2e\text{-}16$) were recorded in the attack frequencies with higher values in *E. grandis* and *N. alba*. This difference in attack intensity reinforces the quantitative consumption data, highlighting the higher voracity and preference for specific wood types of *N. corniger*.

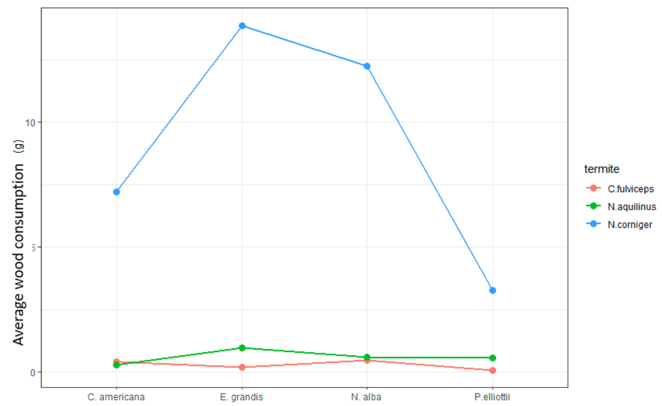

Figure 1. Wood consumption (g) by the termites *C. fulviceps*, *N. aquilinus* and *N. corniger* in laboratory bioassays.

As a result of the exploration activities of termite workers and soldiers (Fig. 2b), their depositions were observed on most of wood pieces. These dark fecal droplets formed partial coatings on the fragments of wood. Subsequently, the termites focused their consumption on some of the pieces, which showed more noticeable damage after the test period. The surfaces of the wooden blocks showed areas of varying extent eroded by the gnawing of the worker mandibles, which at some points reached depths of more than 3 mm (Figs. 2c, wood sample 2). After several days, the pieces were partly or totally covered by a sheltering layer

Table 3. Frequencies of qualitative damage (%) of *C. fulviceps*, *N. aquilinus* and *N. corniger* on the four wood species offered. References: 0: no obvious signs of attack, 1: slight attack, 2: moderate attack, 3: strong attack.

Woods	Frequencies of damage (%)											
	C. fulviceps				*N. aquilinus*				*N. corniger*			
	0	1	2	3	0	1	2	3	0	1	2	3
P. americana	80	20	20	0	80	20	0	0	20	0	0	80
P. alba	60	20	20	0	60	0	40	0	0	0	20	80
E. grandis	80	20	0	0	60	0	40	0	0	0	20	80
P. elliottii	100	0	0	0	40	40	20	0	40	0	40	20

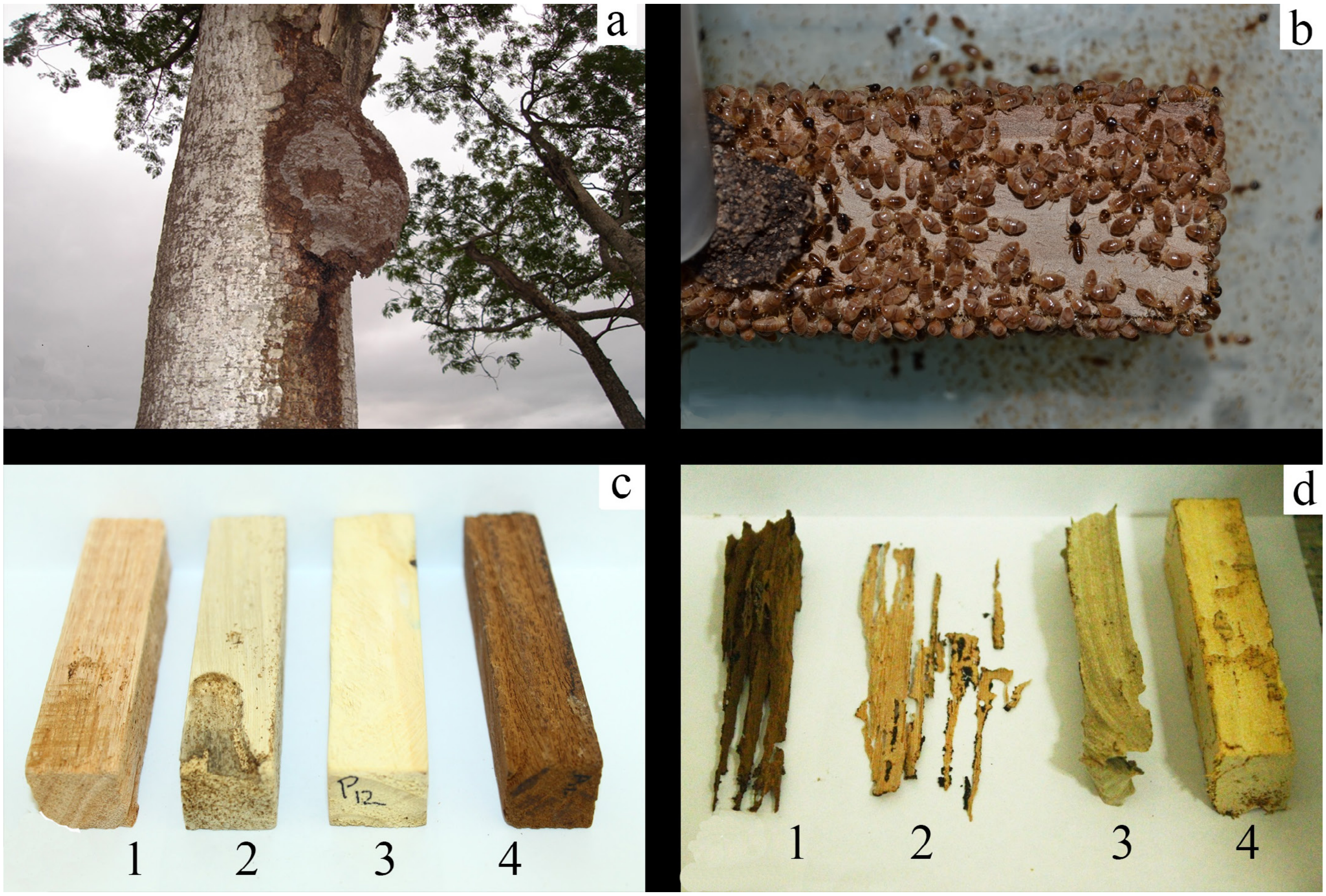

Figure 2. a) Nest of *Nasutitermes aquilinus* on urban tree from Corrientes city; b) *N. corniger* workers and soldiers during exploration activities on a *N. alba* wood block; c) Wood samples partially consumed after the end of the experiments. by *C. fulviceps*: 1: *E. grandis*, 2: *C. americana*, 3: *P. elliottii*, 4: *N. alba*; d) Wood samples consumed by *N. corniger*: 1: *N. alba*, 2: *E. grandis*, 3: *C. americana*, 4: *P. elliottii*.

constructed by the workers, below which they continued to be consumed, leaving in some cases only very small fractions (Fig. 2d, wood samples 1, 2).

Regarding the preference level of each wood, *C. americana* recorded the highest consumption of *C. fulviceps*, but the lowest attack of *N. aquilinus*, while *N. alba* recorded intermediate intakes of the three termites. On the other hand, one of the two introduced species (*E. grandis*) was preferred by the two *Nasutitermes*, while the other exotic wood (*P. elliottii*) was the least consumed by *C. fulviceps* and *N. corniger*. The preferences observed make it possible to establish a certain order of susceptibility of the tested woods. Thus, *E. grandis* appears as one of the most susceptible woods because it was the most attacked by the two *Nasutitermes*. In contrast, *P. elliottii* showed greater resistance to *N. corniger* and *C. fulviceps* but was preferred by *N. aquilinus*.

DISCUSSION

The results of the consumption and feeding preference tests are sometimes difficult to compare to others with different termites and woods or even with the same species, due to intraspecificdifferences (Paes et al. 2003). Also, other factors can influence those results, such as the laboratory conditions in which the colonies were maintained, the number of individuals used in the bioassays, the ways of evaluating the results, etc. (Bustamante and Martius 1998). Despite these difficulties in the comparison of results, the present paper presents the similarities and differences that have been established with previous studies. It has been chosen in this work to carry out simultaneous bioassay tests, which offer discrimination options of a particular feeding substrate over others and highlight the possible preferences of each termite species (Gay et al. 1955; Gazal 2008). In a choice test, the termites can avoid some wood if other options are available, but they could consume it in another situation where it is the only food available in a "conditioned choice" or "compensatory feeding" (Cruz-Rivera and Hay 2000; Peterson and Gerard 2007; Cosme et al., 2020).

The range of feeding preferences observed for *N. corniger* in the experiments agrees with previous observations that have also shown that this termite consumes a wide variety of American and exotic woods, with more or less marked preference levels (Armúa et al., 1996; Bustamante and

Martius, 1998; Vasconcellos and Bandeira, 2000; Paes et al., 2003; Gazal, 2008; Gazal et al. 2010, 2014; Paes et al., 2015; Medeiros Neto et al., 2022). This similarity highlights the consistent polyphagous nature of *N. corniger*, likely due to its adaptability and efficient digestive system, aligning with its ecological role as a significant decomposer of woody material.

In laboratory bioassays performed in Brazil and Perú, *E. grandis* and *Eucalyptus deglupta* Blume were also the preferred and most susceptible woods to *N. corniger* (Gazal et al., 2010; Medeiros Neto et al., 2022). This consistency in preference for *Eucalyptus* species across studies suggests a potential chemical or structural characteristic of these woods that makes them particularly attractive to *N. corniger*.

Other laboratory tests performed with *N. corniger* show lower mass losses in different woods, which in a few cases exceed 10 %. However, in such investigations a predetermined value of 1 g of termites was used, which is approximately 380 individuals, much smaller than the population that occupies an entire nest (Paes et al., 2003, 2015). This difference in results is likely attributable to the significant variation in termite population size used in the bioassays. Larger populations, as used in this study, are likely to result in more extensive wood consumption. For *C. fulviceps* and *N. aquilinus*, the values of loss of mass recorded during this study can be considered as reduced consumptions compared to other experiences with different species of xylophagous termites that show higher percentages (Bustamante and Martius, 1998; Arango et al., 2006; França et al., 2016). The lower consumption rates in these species may reflect differences in their digestive efficiency, foraging strategies, or inherent preferences for other food sources.

Some analyzes identify the density or hardness of each wood as determinants of higher or lower consumption (Bustamante and Martius, 1998; Abreu and Silva, 2000; Arango et al., 2006), while in the present study and others (Paes et al., 2003; Peralta et al., 2004; Gazal, 2008) no such relationships were detected. Wood softness and palatability are a key factor in wood-feedingtermites, with a remarkable preference forsoft woods (Iqbal et al., 2015; Ali et al., 2021). It has also been shown that wood density seems the main determinant of wood resistance against termites (Cosme et al., 2018; Cosme et al., 2020). The contrasting results regarding wood density and hardness highlight the complexity of termite wood selection, suggesting that other factors, such as chemical composition or the presence of decay fungi, may play a more significant role in palatability.

It has been postulated that the degree of palatability of each wood does not depend on a single a conjunction of features, including secondary metabolites (allelochemicals), decay status, and external factors such as fungal presence or environmental conditions, etc. (Bustamante and Martius, 1998; Gazal et al., 2014; Paes et al., 2015, Sadiku et al., 2021). This aligns with the current understanding that termite wood preference is multifactorial, emphasizing the need for studies that consider both physical and chemical wood properties, as well as environmental influences.

The positive relationship between the environmental variables with the consumption of wood by each termite species shows that the test results are influenced by the conditions in which they are carried out. In particular, relative humidity is a key factor for the survival of termites, which have a thin and very poorly sclerotized exoskeleton to protect them from drying. Experiments with subterranean termites of the Rhinotermitidae family show that individuals congregate inside chambers of greater relative humidity, preferring values near 98 % and that mortality increases in chambers with percentages of ≤ 75 % (Gautam and Henderson, 2011). Although in this work this relationship was significant only for one termite species, this factor likelyaffects all the laboratory bioassays with these insects. This finding underscores the importance of controlling and reporting environmental conditions in termite bioassays, as they can significantly influence termite behavior and consumption rates.

The recognition of the stages of initial exploration and recruitment by workers and soldiers of the three species during the bioassays, followed by their concentration on some selected woods, has been previously observed for *N. corniger*. In this species, there is recognition and exploration of the different woods offered, but the final stage of massive recruitment is intensified on the wood for which this species shows a higher degree of preference (Gazal, 2008; Gazal et al., 2010). This behavioral observation is consistent with the known foraging patterns of N. corniger, which exhibits a strong ability to locate and exploit preferred food sources (Armúa et al., 1996).

Similarly to our observations for *E. grandis*, different *Eucalyptus* species have been considered as highly susceptible to *N. corniger*, a termite that shows a remarkable preference for wood of this genus (Armúa et al., 1996; Gazal et al., 2010; Paes et al., 2015). This preference for *Eucalyptus*, which is repeatedly observed, might stem from the specific chemical compounds found in these trees, making them highly palatable to *N. corniger*. Previous laboratory observations also recorded moderate intakes of *N. aquilinus* on untreated control woods of *Eucalyptus saligna* and *P. elliottii* (Armúa et al., 1997). This suggests that although *N. aquilinus* exhibits lower overall consumption than *N. corniger*, it can still utilize *Eucalyptus* species, indicating a potential adaptability to introduced wood sources.

The possible relevance of the analyzed termites as structural pests in the region can be inferred from different biological traits such as their nutritional regimes, nesting patterns and reproductive strategies. *N. aquilinus* and *N. corniger* construct wooden carton nests on native or exotic living or dead trees consuming their wood and foraging out of the nest for other wood pieces that they use as feeding sources (intermediate nests). *C. fulviceps* forages on herbaceous vegetation, feeding on foliage and roots as well as plant debris. Only sporadically this species has been detected consuming remains of *Eucalyptus* log and bark. *C. fulviceps* nests separately from its feeding source, on epigeous mounds constructed with material from the surface soil layers. Inside the nest, the workers store fragments of dry plant material, which serve as food for the colony, as observed in other Nasutitermitinae and Syntermitinae (Torales, 1998; Torales et al., 2005; Lima and Costa- Leonardo, 2007). Despite those differences, the three termites share other biological and morphological traits such as the ability to produce secondary reproductives and the presence of prominent and numerous ridges on the flat molar plate of the right mandible of workers, also described for other species of *Nasutitermes* and *Cortaritermes*. These molar ridges participate in the crushing of the harder vegetal fibers and would indicate that these species are able to feed on little altered wood, as recorded in the bioassays (Donovan et al., 2000; Cuezzo et al., 2015). Likewise, the observed consumptions indicate the importance of these termites in the degradation of ligno-cellulosic materials in natural environments such as the Brazilian Atlantic Forest where a single species (*N. corniger*) consume approximately 6.5% of the fallen woody debris (Vasconcellos and Moura, 2010). This highlights the significant ecological role of *N. corniger* in wood decomposition, which, when coupled with its ability to consume structural timber, underscores its importance as a pest.

Some of the biological traits mentioned for the three termites characterize invasive termites that are severe urban pests worldwide, including exclusive feeding on sound dead wood, intermediate type nesting and secondary reproductive production (Evans et al., 2013). From the bioassays results and considering the biological traits mentioned above, it is possible to infer that two of the evaluated termites (*C. fulviceps* and *N. aquilinus*) might occasionally behave as secondary or minor urban pests, capable of causing moderate damage to different types of wood used in constructions. On the other hand, the results highlight that *N. corniger* can consume important quantities of different woods producing damages of magnitude and allow confirming its status as aserious structural pest. For this reason, it is advisable to monitor and record cases of damage caused by these three termite species on structural timbers in the region.

CONCLUSIONS

The study revealed that all four wood species tested were susceptible to termite attack by *C. fulviceps*, *N. aquilinus*, and *N. corniger*. However, *N. corniger* stood out as the most damaging species, showing significantly higher wood consumption compared to *C. fulviceps* and *N. aquilinus*. The damage caused by *N. corniger* was classified as moderate to severe across all wood types, confirming its status as a high-impact structural pest. In contrast, *C. fulviceps* and *N. aquilinus* caused mild to moderate damage, indicating they are secondary urban pests. Furthermore, no relationship was found between the physical characteristics of the wood analyzed in this study and termite consumption.

Based on the results, it is recommended to conduct further studies to better understand the feeding and nesting behavior of *N. corniger*, especially in urban environments. This could include investigations into their specific wood preferences, their ability to adapt to different building materials, and the effectiveness of various control strategies. Additionally, it is suggested to develop and implement specific management measures to mitigate the impact of *N. corniger* on urban structures, such as the application of preventive wood treatments and the implementation of monitoring systems to detect early infestations. Future research should explore the susceptibility of additional wood species commonly used in construction. Furthermore, exploring biological or chemical control methods, specifically targeting *N. corniger,* could provide practical management strategies.

AUTHOR'S PARTICIPATION

CE, JMC, EL, and CG contributed to the experimental design and field data collection. DDL and JMC performed the statistical data analysis. All authors participated in writing and reviewing the manuscript.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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