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Residence Time and Release of Carbon and Nitrogen from Litter in Caatinga

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Abstract

This study aimed to evaluate decomposition and release of C and of N from the litter of forest Caatinga species in the humification phase, as well as to estimate the residence time of C and N. Litter decomposition of the species was evaluated in 2014/2015 in the municipality of Floresta, Pernambuco, Brazil, using a method of the litter bags at 270; 300; 330; and 360 day. Litter from species of the Fabaceae family presented different decomposition groups, suggesting that decomposition was more influenced by the C/N ratio than N concentration only. The N release was 6.25% greater than the release of C. C will remain in the litter for more time, while N will be almost totally released in approximately 1.14 years. The species litter decomposition were shared, suggesting that the nutrients cycling is fundamental in the preservation of the Caatinga, mainly due to the longer residence time of C.

Keywords: Dry Tropical forest, Forest nutrition, N cycling, C/N Ratio, Litter humification.

1. INTRODUCTION AND OBJECTIVES

Studies on nutrient cycling dynamics have been discussed in several forest formations (Holanda et al., 2015; Grugiki et al., 2017) because litter is an important nutrient source for the maintenance and sustainability of forests (Krishma & Mohan, 2015). The process of deposition and decomposition of litter needs to be further studied in Caatinga because the deposition is dependent of deciduous species and the decomposition is hampered by the low humidity of the environment (Lopes et al., 2015).

The decomposition process occurs in three phases: initial decomposition, biostabilization and humification, where the conversion of plant residues into humid organic matter takes place at different speeds. This separation, first in two phases (Berg & Staaf, 1980) and later in three (Berg, 2014), support studies that aim to increase the understanding of this process. Adair et al.

(2008) using a dataset and model-selection techniques to choose and parameterize a model that describes global patterns of litter decomposition reported that the mass loss was best represented by a three-pool negative exponential model, with a rapidly decomposing labile pool, an intermediate pool representing cellulose, and a recalcitrant pool. Harmon et al. (2009) showed that the comparison of the long-term integrated decomposition rate (which included all phases of decomposition) to that for the first year of decomposition indicated the former was on average 75% that of the latter, consistent with the presence of a slow phase of decomposition. In general, it is known that in dry forests the litter decomposition is influenced by the seasonality of precipitation, as well as by the composition of plant material from different species (Lalnunzira & Tripathi, 2018). Adair et al. (2008) showed in their study that the decomposition rate of all pools was modified by climate, but the intermediate pool of

the decomposition rate was also controlled by relative amounts of litter cellulose and lignin.

Different species in semiarid environments may differ in terms of decomposition rates because of interspecific variations in the quality of the litter produced (Koukoura et al., 2003). These litter decomposition variations are also influenced by the C and N concentrations of plant material produced by different species (Bargali et al., 2015). Therefore, it is important to understand the decomposition and composition of plant residues of different species because most of the nutrient supply that maintain the stability and functionality of the system comes from this material, which then represents a relevant stage of the nutrient cycling process (Holanda et al., 2015).

Another important factor that needs to be further studied in the Caatinga biome is the residence time of C and N in the above-ground biomass or its stock in the soil. Yizhao et al. (2015) studying the role of residence time in diagnostic models of global C storage capacity showed that the baseline residence time was stable for each biome, ranging from 12 to 53.7 years for forest biomes and 4.2 to 5.3 years for non-forest biomes. Araújo Filho et al. (2018) reported that the average time for C in soil and humic fractions to return to their initial values at these sites is estimated to be approximately 65 years. Santana et al. (2019) studying C and N stocks of soils under different land uses in semi-arid showed that N stocks did not differ among land uses, implying that losses are greater for C than for N. Moura et al. (2016) found higher C flows in Caatinga at intermediate stages of regeneration. Therefore, the residence time of C was longer, as the Caatinga matured.

Our hypothesis is that litter decomposition may vary according to species N concentration or C/N ratio, tending to be a more individualized and less shared process because N concentration or C/N ratio is an inherent characteristic of each species. We also hypothesize that in the humification phase the N release is greater than the reduction of C mass. However, the speed of this release depends on the concentration of N in the litter. Thus, this study aimed to evaluate decomposition and release of C and of N from the litter of forest Caatinga species in the humification phase, as well as to estimate the residence time of C and N.

2. MATERIALS AND METHODS

2.1. Study area

The study was carried out in a hyperxerophitic Caatinga fragment located in the municipality of Floresta, Pernambuco (Figure 1). The study area is located at coordinates 08°30'37' S and 37°59'07" W and has approximately 53 ha of native Caatinga vegetation without any anthropic exploitation for 45 years (Ferraz et al., 2014).

The study area has a rainy season beginning in January and ending in April. The climate is classified as BSh (hot semiarid), according to the Köppen classification (Alvares et al., 2013). The average annual rainfall is 500 mm, average annual temperature of 28 ºC, average annual of potential evapotranspiration of 1,646 mm, and low relative humidity (Araújo Filho et al., 2018).
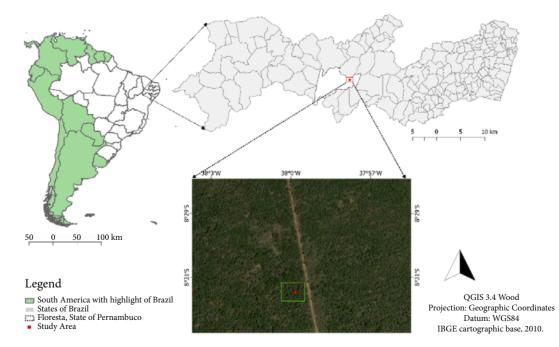

Figure 1. Map of South America and the state of Pernambuco, with emphasis on the municipality of Floresta and study area.

2.2. Horizontal structure of the forest fragment

The study of the horizontal structure of the forest fragment was carried out through a phytosociological inventory in 40 fixed plots of 625 m² (25 m x 25 m) systematically distributed 80 m apart (Ferraz et al., 2014). In each plot, all adult tree individuals with a diameter at breast height (DBH) at 1.30 m above the ground of ≥ 6.0 cm were measured and identified. Density, frequency and dominance, absolute and relative were estimated from data obtained in the phytosociological study of vegetation. Thus, were chosen seven tree species with higher absolute density in the fragment (Table 1).
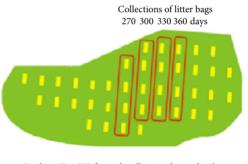
Table 1. Absolute density (AD) of the species, families, carbon, nitrogen concentrations and C/N ratio of the leaf component of the species in a Caatinga area in the municipality of Floresta, Pernambuco, Brazil.

Species	Families	AD (Ind. ha^{-1})	C (g kg^{-1})	N (g kg^{-1})	C/N
Poincianella bracteosa (Tul.) L. P. Queiroz	Fabaceae	1031	450.5	31.08	14.49
Mimosa ophtalmocentra Benth.	Fabaceae	330	573.0	53.34	10.74
Bauhinia cheilantha (Bong.) Steud.	Fabaceae	133	573.0	34.86	16.44
Aspidosperma pyrifolium Mart.	Apocynaceae	126	576.5	32.48	17.75
Anadenanthera colubrina var. *cebil* (Griseb.) Altschul	Fabaceae	101	576.0	30.94	18.62
Jatropha mollissima (Pohl) Baill.	Euphorbiaceae	94	489.0	38.78	12.61
Mimosa tenuiflora (Willd.) Poir.	Fabaceae	45	585.0	46.90	12.47

2.3. Litter decomposition

Litter decomposition was evaluated using the litter bags method (Bocock & Gilbert, 1957). This method consists of storing a known quantity of plant material (only leaves, no soil) in closed bags and assessing the mass loss over time. The litter bags used in this study were made of nylon (1 mm² mesh), with dimensions of 20 cm x 20 cm.

The litter bags were filled with leaves collected from healthy tree individuals and sampled in the middle third of the plants at the four cardinal points. Leaves were dried in an oven with forced air circulation at 65 ºC until constant mass. The sampling of the trees was carried out in the rainy season of 2014 (February/May) because the species with the highest absolute density used in the study (Table 1) lose their leaves in the dry season (main litter fall season in the region). Then, 10 g of dry mass from each species were weighed to fill the litter bags, which were later randomly distributed in some plots used in the phytosociological study. This distribution was carried out in the central plots, distributing 16 litter bags per species. Thus, four litter bags per species were collected in four different collection periods. For seven species, 112 litter bags were distributed (Figure 2).

Collections of litter bags
270 300 330 360 days

Replicas (I to IV) for each collection date radomly distributed

Figure 2. Schematic drawing of the highlighted plots where the litter bags were distributed. Each highlight represents a collection period (270, 300, 330 and 360 days) and its respective replicas.

2.4. Incubation procedure

The experiment was installed at the beginning of the dry period (May/2014) and evaluations started in the wet period (February/2015) (Figure 3), when 70-80% of the mass was already lost (Harmon et al., 2009). Although the release of N

from the litter starts early during the decomposition process (Parton et al., 2007), the plant material was in the final stage of decomposition (humification) (Berg, 2014), period of much N release (Berg, 1987). Therefore, four litter bags per species were collected at 270; 300; 330 and 360 days after the incubation, representing the replicates. The litter material was cleaned to ensure minimal adherence of soil particles to the litter. Data of rainfall and air temperature of the incubation period were obtained in the Laboratory of Meteorology (LAMEP) of the Institute of Technology of Pernambuco (ITEP) (Figure 3).
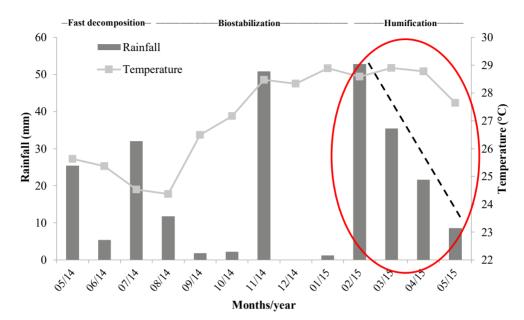

Figure 3. Rainfall precipitation and average air temperature during the experimental test period indicating the humification phase where the litter bags were collected in the municipality of Floresta, Pernambuco, Brazil.

2.5. Release of C and N

The release of C and N were evaluated by measuring C and N of the litter in the humification phase at 270; 300; 330 and 360 days after the installation of the litter bags. The mass of the litter bags and the concentration of C and N were used to calculate the release of these elements. C concentration was performed using the Walkley-black method, which considers the oxidation of organic matter in the presence of sulfuric acid and potassium dichromate with external heat (Yeomans & Bremmner, 1988). The N was determined by the Kjeldahl method after sulfuric digestion of the litter (Sáez-Plaza et al., 2013).

2.6. Calculations and statistical analyses

The data set obtained was initially tested for normal distribution of errors and variance homogeneity. The Shapiro-Wilk tests ($p < 0.05$) were performed (Shapiro & Wilk, 1965). Litter decomposition was calculated as cumulative mass loss (%) and by calculating the decomposition constant (k) was estimated by adjusting a single exponential model, as proposed by Berg (2014). This model adjusted to the data and presented significant decomposition constant (k) values and R^2 values.

The decomposition constant (k, g g^{-1} day^{-1}) was calculated as:

$$k = -\frac{\ln\left(\frac{Mt}{M0}\right)}{t} \quad (1)$$

In which: M0 is the initial litter dry mass (g); Mt is the dry mass (g) at sampling time t (day) (Olson, 1963).

The half-life, that is, time for 50% of the litter mass to be decomposed, was calculated according to Olson (1963) using the equation:

$$t_{50\%} = \frac{0.693}{k} \quad (2)$$

In which: $t_{50\%}$ is half-life time (days); 0.693 is the natural log of half-time (i.e. 0.5); k is the decomposition constant (g g^{-1}day^{-1}).

The estimated time for the decomposition of 95% of the litter mass was obtained using the equation (Olson, 1963):

$$t_{95\%} = \frac{3}{k} \quad (3)$$

In which: $t_{95\%}$ is the time for 95% of the litter mass to be decomposed (day); 3 is the natural log for the decomposition of 95% (i.e. 0.05); k is the decomposition constant (g g^{-1} day^{-1}).

The release of C and N (%) were obtained using the equation:

$$y = \frac{M0X0 - MtXt}{M0X0} * 100 \quad (4)$$

In which: y is the release (%); M0 and Mt are respectively the initial litter mass and the litter mass at time t (g); and X0 and Xt are the element concentrations C and N (g kg⁻¹).

The release rate (k, g g⁻¹ day⁻¹) of C and N was calculated using equation 1, considering the initial and final concentration of the elements C and N and the initial and final litter mass.

The half-life and the time for 95% of the C and N to be released were estimated, according to equations 2 and 3, respectively. We correlated the decomposition rate of the litter mass and the release rate C and N.

The decomposition rates, half-life time and time for 95% of the plant material to be decomposed or C and N to be released were obtained in each litter bag replicate. With these values, an analysis of variance (ANOVA) and a F test ($p<0.05$) were performed, comparing these variables by forest species. The difference between the means was assessed by the Scott Knott test ($p<0.05$) using the ASSISTAT 7.7 software (Silva & Azevedo, 2016).

3. RESULTS

The litter decomposition of the species showed the same trend, with a greater litter mass loss in the phase that preceded humification, i.e until 270 days after deposition of the litter bags (Figure 4), even though there was a lot of variation in rainfall and temperature during this period (Figure 3).

In the humification phase, differences were observed in cumulative mass loss of species, with *M. tenuiflora* being the one that presented most litter mass loss, starting with an average mass loss of 75% at 270 days and reaching 98% at 360 days, which represents a mass reduction of 23% in the humification phase (Figure 4). Litter of the species *J. mollissima* and *A. colubrina* presented an antagonistic behaviour, with the slowest decomposition, starting with an average litter mass loss of 75% at 270 days and reaching a mass loss of 82% by the end of the evaluation, which represented a mass reduction of only 7% in plant material (Figure 4). Litter

decomposition in other species showed a behaviour similar to *M. tenuiflora* (*A. Pyrifolium*, *M. ophtalmocentra* and *B. Cheilantha*), with the exception of *P. bracteosa* which showed a behaviour similar to *J. mollissima* (Figure 4).

The C release in the litter as a function of time showed an increase exponential (Figure 5a), as also occurred with the cumulative increase in litter mass loss (Figure 4). Litter of *A. pyrifolium* started the humification phase with 75% of C having already been released in the previous stages of decomposition. After 270 days, this species released more 10% of its C up to 360 days after the deposition of the litter bags. Therefore, the released of C in this species was low when compared to the other species (Figure 5a). The species that showed the greatest gradual release of C in litter was *M. tenuiflora*, which started the humification phase with 80% of C having already been released and ended releasing approximately all of the C from its litter (Figure 5a).

In the humification phase, it was observed that there was a significant release of N from the species litter (Figure 5b). Litter of *M. tenuiflora* released at 300 days after decomposition all N contained in the litter bags, while *A. pyrifolium* still had around 10% N to release at 360 days after decomposition (Figure 5b).

The C/N ratio of the litter of the species changed little during the humification phase, with the exception of the litter of *A. colubrina*, which increased 360 days after decomposition (Figure 5c).

The decomposition rate (k) varied between 0.0051 and 0.0103 g g⁻¹ day⁻¹ (Table 2). The litter decomposition rate of *M. tenuiflora* was ~ 2 times higher than *P. bracteosa*, *B. cheilantha*, *A. pyrifolium* and *J. mollissima*. Therefore, it has been estimated that these species need around 130 days to decompose 50% of their litter, and around 1.54 years to decompose 95% of the litter they deposit. Meanwhile, 50% of the litter of *M. tenuiflora* decomposes in 66 days. Half of the decomposition must occur within the period of greatest water availability (Figure 3).
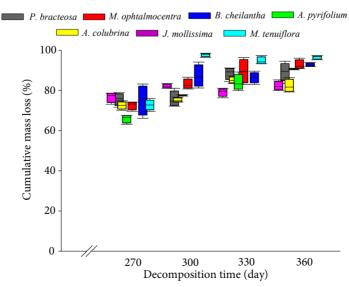

Figure 4. Boxplot of the dynamics of cumulative mass loss of the litter of species in the humidification phase of the decomposition.
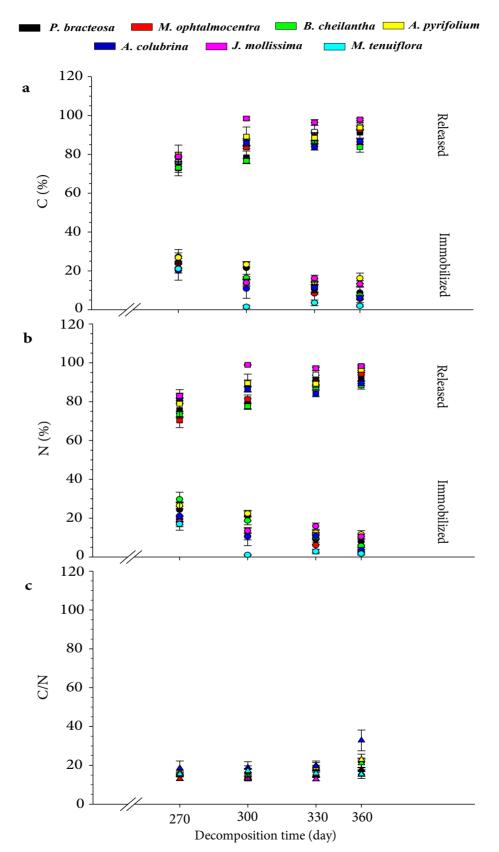
Figure 5. Dynamics of carbon (a) and nitrogen (b) released or immobilized, and C/N ratio (c) of the litter of species in the humidification phase of the decomposition.

Table 2. Decomposition rate (k), half-life time (t50%) and time so that 95% (t95%) of the litter mass to decompose, and release rate of carbon and nitrogen of forest species in the Caatinga area in the municipality of Floresta, Pernambuco Brazil.

Species	Decomposition indicators		
	k	$t_{50\%}$	$t_{95\%}$
	(g g^{-1} day^{-1})	day	year
	Litter mass		
Poincianella bracteosa	0.0054 ± 0.0006 c	127 ± 13 a	1.51 ± 0.15 a
Mimosa ophtalmocentra	0.0065 ± 0.0007 b	103 ± 10 b	1.22 ± 0.12 b
Bauhinia cheilantha	0.0056 ± 0.0006 c	123 ± 12 a	1.46 ± 0.15 a
Aspidosperma pyrifolium	0.0051 ± 0.0005 c	134 ± 14 a	1.60 ± 0.16 a
Anadenanthera colubrina	0.0065 ± 0.0007 b	104 ± 11 b	1.23 ± 0.12 b
Jatropha mollissima	0.0051 ± 0.0005 c	134 ± 14 a	1.59 ± 0.16 a
Mimosa tenuiflora	0.0103 ± 0.0011 a	66 ± 7 c	0.78 ± 0.09 c
Average	0.0064	113	1.34
F (6 and 21 DF, species and error)	31.366 (p<0.0001)	18.332 (p<0.0001)	18.336 (p<0.0001)
CV (%)	10.42	10.10	10.10
	Carbon		
	(g g^{-1} day^{-1})	day	year
Poincianella bracteosa	0.0063 ± 0.0006 c	111 ± 9 b	1.32 ± 0.10 b
Mimosa ophtalmocentra	0.0075 ± 0.0007 b	93 ± 7 c	1.10 ± 0.08 c
Bauhinia cheilantha	0.0064 ± 0.0006 c	108 ± 8 b	1.28 ± 0.10 b
Aspidosperma pyrifolium	0.0053 ± 0.0005 c	132 ± 10 a	1.56 ± 0.12 a
Anadenanthera colubrina	0.0073 ± 0.0007 b	96 ± 7 c	1.13 ± 0.09 c
Jatropha mollissima	0.0060 ± 0.0006 c	117 ± 9 b	1.38 ± 0.11 b
Mimosa tenuiflora	0.0116 ± 0.0011 a	61 ± 5 d	0.72 ± 0.06 d
Average	0.0072	102	1.21
F (6 and 21 DF, species and error)	37.729 (p<0.0001)	33.152 (p<0.0001)	33.151 (p<0.0001)
CV (%)	9.38	7.66	7.66
	Nitrogen		
	(g g^{-1} day^{-1})	day	year
Poincianella bracteosa	0.0062 ± 0.0005 c	113 ± 7 a	1.34 ± 0.08 a
Mimosa ophtalmocentra	0.0088 ± 0.0007 b	80 ± 5 c	0.95 ± 0.06 c
Bauhinia cheilantha	0.0068 ± 0.0005 c	103 ± 6 b	1.22 ± 0.08 b
Aspidosperma pyrifolium	0.0057 ± 0.0004 c	121 ± 8 a	1.44 ± 0.08 a
Anadenanthera colubrina	0.0079 ± 0.0006 b	88 ± 6 c	1.04 ± 0.07 c
Jatropha mollissima	0.0063 ± 0.0006 c	110 ± 7 b	1.30 ± 0.08 b
Mimosa tenuiflora	0.0123 ± 0.0010 a	56 ± 4 d	0.67 ± 0.04 d
Average	0.0077	96	1.14
F (6 and 21 DF, species and error)	64.177 (p<0.0001)	56.739 (p<0.0001)	56.737 (p<0.0001)
CV (%)	7.50	6.29	6.29

Means followed by the same letters in the column by variable and by decomposition indicator do not differ statistically by the Scott-Kynott test (p<0.05). (DF): Degrees of freedom; (CV): Coefficient of variation.

The release of C and N from the litter of the species showed the same behavior. *M. tenuiflora* was the species that released more C and N in less time (Table 2). The other species formed two groups: *M. ophtalmocentra* and *A. colubrina* released an average of 36% less C and 32% less N than *M. tenuiflora*; *P. bracteosa*, *B. cheilantha*, *A. pyrifolium* and *J. mollissima* released an average of 48% less C and 49% less N than *M. tenuiflora*.

In this same group, the species *A. pyrifolium* was the one that needed more time to release C and N from its litter (Table 2).

The litter decomposition rate correlated with the C and N release rates (Figure 6). However, the C release rate was better correlated with the cumulative litter mass loss. The rate of N release varied more than the rate of C release at the beginning of the humification phase (Figure 6).
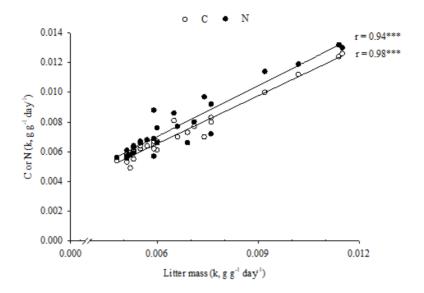
Figure 6. Correlation between the release rate of carbon and nitrogen and the rate of decomposition of litter mass of forest species in the Caatinga in the municipality of Floresta, Pernambuco, Brazil. (p<0.0001).

4. DISCUSSION

The results showed that there was a difference in species behaviour in the humification phase. Bargali et al. (2015) found in an area of dry tropical forest in China that the decomposition rate was higher in three of the four species studied. However, the decrease in litter mass was greater in the first 129 days after the deposition of litter bags. In our study, it was observed that the largest loss in litter mass occurred before 270 days, though after that period and up to 360 days (humification phase) the litter mass showed a different decrease and depended on species, which can be associated to specific chemical composition of the litter of each species.

A study developed by Souto et al. (2013) observed in the Caatinga of Paraíba that decomposition was greater in the first six months. This period corresponded to the beginning of the rainy season, reflecting an increased activity of decomposing microorganisms which have their activity limited by the lack of water. Santonja et al. (2017) suggest that decrease in precipitation results in slower decomposition rates. In our study, there was a lot of irregularity in rainfall in the nine months preceding the humification phase, but nevertheless the decrease in litter mass varied between 70 and 80%, showing that the rain peaks recorded in May, July and November/2014 were sufficient to decompose a large part of the litter (Figure 3). This demonstrates the importance of moisture in this decomposition process. In the humification phase, the rainfall distribution was balanced, starting with ~ 50 mm and gradually decreasing. This allowed a better evaluation of the decomposition process.

During the humification period, differences were found in the litter mass decrease of the species, with litter from *J. mollissima* and *A. pyrifolium* showing the lowest decompositions, and consequently longer half-life times. These species belong to the Euphorbiaceae and Apocynaceae families, respectively. They are native to Northeast Brazil and adapted to environments with high evaporation and low water potential (Ferraz et al., 2014), showing to be adapted to the conditions in that region. Additionally, they are non-N-fixing species and their decomposition is hampered by low concentrations of N and high C/N ratio, especially the species *A. pyrifolium* (Table 1).

Grugiki et al. (2017) studying the litter decomposition of three forest species (*Acacia mangium*, *Sapindus saponaria* and *Hevea brasiliensis*) found a lower decomposition speed in *Hevea brasiliensis*, which is also from the Euphorbiaceae family. This may be a peculiarity of this genera, and the authors attributed this low decomposition to the longer duration of recalcitrant compounds in this species litter. This finding does not occur frequently in species of the Fabaceae family, for example (Holanda et al., 2015).

However, in our study we found that not all species of Fabaceae family showed higher decomposition rates of their litter. *P. bracteosa* and *B. cheilantha*, which belong to the Fabaceae family, presented decomposition rates similar to *J. mollissima* and *A. pyrifolium*. Different decomposition rates are not only related to highest concentrations of N (Krishna & Mohan, 2017). The quality of litter, such as the presence of fibre and other recalcitrant compounds, can also influence decomposition speed (Anderson, 1988; Couteaux et al., 1995). However, Cunha Neto et al. (2013) found that a species of the genus *Mimosa* was

the most efficient in nutrient cycling as its litter decomposition occurred more quickly than that of other studied forest stands.

Litter of different species decomposes at different rates due to variations in leaf characteristics (Cornelissen, 1996; Cornelissen et al., 1999; Hättenschwiler et al., 2008; Bakker et al., 2011; Salinas et al., 2011). Microclimate conditions such as soil and air temperature and water in pore spaces in soil from tropical forest ecosystems strongly influence litter decomposition (Jeyanny et al., 2015).

In general, it is known that decomposition is highly influenced by humidity and temperature (Lalnunzira & Tripathi, 2018). As all species were in the same environmental conditions in our study, humification was influenced by species composition, that is, by the quantity and quality of their biochemical constitution.

The differences in litter decomposition of species in a forest stand, as found in this study, showed that nutrient cycling was shared, i.e. when the litter of a group of species ceased its decomposition other groups began to assume this role. When this occurs, nutrient cycling becomes sustainable and continuous. We found that the species *M. tenuiflora* were responsible for N release at the beginning of the litter humification phase; then *A. colubrina* and *A. ophtalmocentra* assumed this role; and later it was completed by *B. cheilantha*, *J. mollissima*, *P. bracteosa* and *A. pyrifolium*. This means that the decomposition speed is not a credential to define whether a species is more or less efficient in nutrient cycling. This difference in decomposition speed of the species favours the cycling of nutrients from the plant community. This more shared model is likely to occur in more balanced ecosystems such as the one in our study, which has been preserved for over 40 years. Anthropic exploration of Caatinga that ignores studies like this can compromise nutrient cycling and impact the use of this type of vegetation, reducing its growth, productivity and ecosystem services.

The reduction rate of litter C mass was different in all species of the Fabaceae family, indicating that the quality of plant material is important, but they all had a different initial C/N ratio (Table 1). Holanda et al. (2015) found a small increase in C concentrations after 270 days, which was associated with the mixture of species. However, the authors did not calculate the mass of C, which in these studies is a better indicator of decomposition than concentration. Zeng et al. (2018) comparing decomposition at different stages revealed that most of the mass reduction and nutrients release occurred between 181-240 days due to the fact that temperature was higher, and rainfall was more frequent. This allowed the authors to infer that factors such as precipitation and temperature directly influence the decomposition process, regardless of the phase of the process.

Our study showed that, on average, the C mass of the litter remains for 1.21 years and in some species such as *A. pyrifolium* for more than 1.56 years (Table 2). Araújo Filho et al. (2018) studying C in the soil of a Caatinga forest showed that the recovery of the initial C stock when the forest is cut down can extend for up to 65 years. This high C residence time in the litter shows that the practice of burning, which is widely used in the semiarid region, significantly influences C losses, especially when litter is from high resilience species, compromising the soil C stock as it is the main recipient and store of C in litter (Moura et al., 2016).

The reduction in N mass in species litter was not as different as that of C, with N being released in the humification phase. These findings were also observed by Holanda et al. (2015) that reported a reduction in the N concentration between 270 - 360 days of decomposition. According to Xuluc-Tolosa et al. (2003), C is used as an energy source by decomposers during decomposition, while N is assimilated into cellular proteins that are essential for microbial function. Therefore, a higher N concentration in the leaf promotes greater decomposition. This was observed in the two species of the genus *Mimosa* in this study (Table1 and Table 2).

5. CONCLUSIONS

Litter from species of the Fabaceae family presented different decomposition groups, suggesting that decomposition was more influenced by the C/N ratio than N concentration only. The N release was 6.25% greater than the release of C. C will remain in the litter for more time, while N will be almost totally released in approximately 1.14 years. The species litter decomposition were shared, suggesting that the nutrients cycling is fundamental in the preservation of the Caatinga, mainly due to the longer residence time of C.

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AUTHORS' CONTRIBUTIONS

Aghata Maria de Oliveira Silva: Formal analysis (Supporting); Methodology (Supporting); Writing-original draft (Equal).

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Mozart Duarte Barbosa: Data curation (Equal); Methodology (Equal); Writing-original draft (Equal).

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