Original Article

EFFECTS OF EUCALYPTUS PLANTATIONS ON SOIL ARTHROPOD COMMUNITIES IN A BRAZILIAN ATLANTIC FOREST CONSERVATION UNIT

EFEITOS DE PLANTIOS DE EUCALIPTO SOBRE A COMUNIDADE DE ARTRÓPODES DO SOLO EM UMA UNIDADE DE CONSERVAÇÃO DA MATA ATLÂNTICA

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ABSTRACT: The Atlantic Forest is a conservation hotspot due to its elevated level of biodiversity and current state of degradation. Some areas of Atlantic Forest have been replaced by eucalyptus monocultures in Brazil. Soil arthropods can be important indicators for assessing the recomposition of native forests after disturbs. This study aimed to test the hypothesis that exist differences in the composition and structure of soil arthropod communities among two plantations of eucalyptus (*Corymbia citriodora*) in different stages of natural regeneration of Atlantic forest (YP = Young Plantation and MP = Mature Plantation, in less and more advanced stage of regeneration, respectively) and a fragment of Atlantic forest (FOREST), in wet and dry seasons, in União Biological Reserve, Brazil, using *pitfalls*. Archaeognatha, Diplura, Opilionida, and Thysanura were restricted to the FOREST, while Diptera, Isoptera, and Orthoptera were favored by the microclimatic conditions in eucalyptus plantations. Soil arthropod community in FOREST was more complex than those in eucalyptus plantations. In general, soil arthropod communities showed higher total abundance and richness of groups, while equability decreased, as regeneration of Atlantic forest advanced in eucalyptus plantations, making this community more similar to that observed in the FOREST. The average total abundance, average richness, and total richness of soil arthropods were higher in the wet season in all areas, but the opposite occurred for the equability. Soil arthropod community improved with the regeneration of native forest species under the eucalyptus plantations.

KEYWORDS: *Corymbia citriodora*. Ecological indicators. Edaphic fauna. Regeneration.

INTRODUCTION

The largest portion of biological diversity in all habitats is represented by arthropods (DUELLI et al., 1999). Nevertheless, studies that measure loss of habitat quality commonly focus on vegetation and forest fauna. Less emphasis has been given to the arthropods that inhabit soil permanently or in at least one of their stages of development (DORAN; ZEISS, 2000), despite their essential role in the decomposition and mineralization of the organic matter found in soil, which are vital processes for the sustainability of natural and unmanaged ecosystems (LAVELLE, 1996).

Soil arthropods can be efficient ecological indicators because they respond to human pressure on forests through alterations in their community (RAINIO; NIEMELÄ, 2003), with a reduction in the abundance and/or richness of their community as a whole and/or of the diverse groups which compose it (DUARTE, 2004; BARETTA et al., 2008; COPATTI; DAUDT, 2009). The employment, however, of these organisms as bioindicators of ecosystem quality is still incipient (LEWINSOHN et al., 2005), since the importance of the relation between the dynamics of soil degradation and the decline of soil fauna activities has not been fully appreciated (LAVELLE et al., 1994). The potential for arthropods as indicators is especially promising in the case of the Atlantic Forest, for which scarce available data exist (DUARTE, 2004; BARETTA et al., 2008; COPATTI; DAUDT, 2009; FERREIRA; MARQUES, 1998; MOÇO et al., 2003; SOUZA et al., 2008), despite this biome's status as a conservation hotspot (MYERS et al., 2000) and the important pressure to the expansion of agro-forestry systems, which includes the replacement of native forests by eucalypt plantations for industrial use (LIMA, 1996). Thus, studies aimed at addressing this aspect can contribute substantially to the monitoring of the functioning and conservation of ecosystems that were submitted to the impacts of anthropic activities and belong to this important biome.

In this context, the present study aimed to test the hypotheses that exist differences in the composition and structure of soil arthropod

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communities: (a) between two plantations of eucalyptus (*Corymbia citriodora*) in different stages of natural regeneration of Atlantic Forest species in Brazilian biological reserve; (b) between these plantations and a fragment of Atlantic Forest in this biological reserve; and (c) between different climate seasons within these same areas.

MATERIAL AND METHODS

Study site

This study was performed in the União Biological Reserve (22º 27' 30"S e 42º 02' 15"W), located in Rio de Janeiro State, Brazil, whose total area is 3,12 ha of which 2,22 ha are covered by Atlantic Forest (LAPENTA et al., 2003). The other part of the area is occupied by abandoned eucalyptus plantations of different ages (220 ha), as well as fields and pastures, roads, and an industrial area (506 ha) (IBAMA, 2007).

Part of the forest of the study area was logged in the 1930s for wood to be used in steam locomotives and later plantations of *Eucalyptus grandis* W. Hill ex Maiden were established for the same purpose in the 1960s and, subsequently, of *Corymbia citriodora* (Hook.) K. D. Hill & L. A. S. Johnson, other eucalyptus species, in the 1970s to produce railroad ties (EVARISTO et al., 2011). In 1998 the União Biological Reserve was created as a conservation area that would help preserve the habitat of *Leontopithecus rosalia* (golden lion tamarin), an endemic species of primate threatened with extinction (EVARISTO et al., 2011).

According to Köppen's classification, the predominant climate in the region is humid tropical with a dry winter (Aw), with an average annual temperature of 22 ºC and an average rainfall of 2.337 mm year^{-1}, with 89% concentrated between October and April, in 2009 (Figure 1). The forest growths in Inceptisol and the eucalyptus stands were planted in Ultisol (MIRANDA et al., 2007).

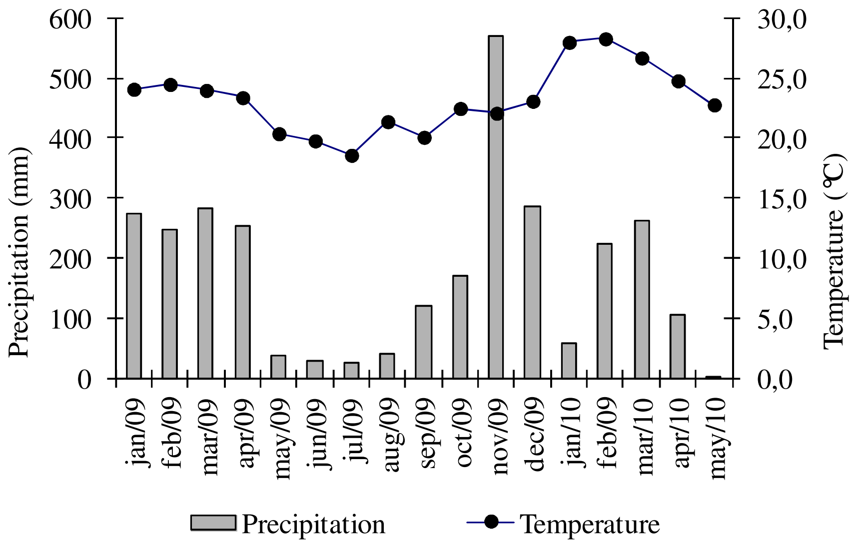

Figure 1. Monthly average temperature and rainfall at União Biological Reserve, Brazil. Collected by Golden Lion Tamarin Association.

The soil arthropods community was studied in two *Corymbia citriodora* plantations of different ages that have been unmanaged since 1996: Young Plantation (YP) and Mature Plantation (MP), which were established in 1991 and 1968, respectively (IBAMA, 2007), and in a fragment of the native Atlantic Rainforest (FOREST) located approximately 400 m apart from both the *Corymbia citriodora* plantations (EVARISTO et al., 2011).

The MP has a plantation spacing of 3.0 m x 3.0 m and an area of 11.4 ha, while the YP has a 7.2 ha area and spacing of 1.5 m x 3.0 m (IBAMA, 2007). The tree species community of the Atlantic Forest in natural regeneration in the MP understory presents a more developed structure, higher density of live adult individuals, denser canopy, and higher diversity than that of YP, with *Xylopia sericea* being the most important species in the regeneration of

MP and *Myrsine coriacea* in the YP (EVARISTO et al., 2011).

Experimental design

Evaluations of the natural regeneration of Atlantic Rainforest native tree species were carried out in five plots (5 m x 20 m) installed in each of the two eucalyptus plantations: YP and MP (EVARISTO et al., 2011). The sampling of soil arthropods community was performed by means of two pitfalls traps installed randomly in each one of these plots, obtaining ten pitfalls in each plantation. In the FOREST, a 50-meter transect was settled starting 100 m from the edge, and pitfalls were installed at five meters apart each one, obtaining ten pitfalls in this area.

Each trap was considered an experimental unit. These traps, which allow the indirect evaluation of the abundance of taxonomic groups that reflects "activity-density", which can be affected by habitat (APIGIAN et al., 2006), were employed in the wet season (January) and dry season (August) of 2010.

The arthropods collected were identified by the use of pertinent literature (COSTA et al., 1988; VAN ACHTERBERG, 1991). Formicidae was considered a taxonomic group apart from Hymenoptera, because of the facility of identification. Collembola was subdivided in three taxonomic groups: Entomobryomorpha, Poduromorpha and Symphypleona.

This study estimated average total abundance for each group was estimated, expressed in number of individuals per trap per day, average richness, considering the average of the number of taxonomic groups within the experimental units in each area, total richness or the total number of taxonomic groups in each area, the relative participation (%) of the taxonomic groups and the equability (Pielou Index). The equability index varies between zero and one, and the distribution of individuals within taxonomic groups became more equal as the value of this index became closer to one (ODUM, 1988).

The comparisons among the different areas within the same climate season were performed by the non-parametric statistical Kruskal-Wallis Test. In order to compare the results between different seasons within the same area, the non-parametric statistical Mann-Whitney Test was employed (ZAR, 1984).

Statistical analyses were carried out with Statistica 7.0 program. The Sorensen index was used to calculate the similarity between the areas in relation to the taxonomic groups' composition.

RESULTS

Thirty-three soil fauna taxonomic groups were found in the União Biological Reserve. More than half of the total taxons (61%) were common to the two plantations and the FOREST. Archaeognatha and Thysanura, both saprophage groups, and the predators Diplura and Opilionida were restricted to the FOREST, while Isoptera occurred only in the two eucalyptus plantations. Pseudoscorpionida (predators) were absent in the MP, though they were found both in the YP and the FOREST in the wet season. In the dry season, this group was only encountered in the FOREST. Diplopoda (saprophages), Mantodea and Trichoptera's larvae were only sampled in the MP. However, Coleoptera (adult individuals and larva), which involve predators and another functional groups, Heteroptera (herbivorous) and Isopoda (saprophages) were equally present in the MP and the FOREST, but were not observed in the YP (Table 1).

The FOREST presented an abundance of Araneae (predators) and Entomobryomorpha (microphage or saprophage) significantly higher than in the plantations during the wet season. The abundance of Coleoptera and Hymenoptera (predators) was significantly higher in the FOREST than in the MP in the wet season. The abundance of Coleoptera was significantly higher in the FOREST than in the YP in the dry season. The opposite occurred for Orthoptera in wet season and for Auchenorrhyncha in the dry season. The YP showed significantly higher abundance of Diptera when compared to other locations in the wet season. This pattern was also observed in the MP for Acari, also in the wet season (Table 1).

Formicidae was one of the most abundant groups in all of three study areas, in both climactic seasons, although there were differences with respect to the participation of the most abundant taxonomic groups (Table 1). Entomobryomorpha represented the highest contribution in total abundance of the soil arthropod community in FOREST - more than 60% - in both climate seasons (Table 1). The contribution of Entomobryomorpha increased as the natural regeneration developed in eucalyptus plantations: from 5% in YP to 30% in MP, in the wet season, and from 8% in YP to 65% in MP, in the dry season (Table 1). The opposite was observed in relation to Diptera's participation: the contribution of this taxonomic group decreased from 28% in YP to 6% in MP, in the wet season, and from almost 29% in YP to almost 12% in MP, in the dry season (Table 1).

Table 1. Average abundance (number of individuals pitfall^{-1} day^{-1} ± standard error) of soil arthropods in *Corymbia citriodora* (eucalyptus) and in Atlantic Rainforest at União Biological Reserve, Brazil[1]

Taxonomic groups	Eucalyptus				Atlantic Rainforest	
	Young plantation		Mature plantation			
	Abundance	%	Abundance	%	Abundance	%
			Wet season (January 2010)			
Acari	1.00 ± 0.31 B	4.76	3.61 ± 1.02 A	15.33	1.04 ± 0.34 B	3.00
Araneae	0.40 ± 0.08 B	1.90	0.43 ± 0.10 B	1.83	0.96 ± 0.14 A	2.77
Archaeognatha	-	-	-	-	0.07 ± 0.03 A	0.20
Auchenorryncha	0.41 ± 0.16 A	1.95	0.34 ± 0.13 A	1.44	0.40 ± 0.06 A	1.16
Blattodea	0.16 ± 0.05 A	0.96	0.10 ± 0.06 A	0.42	0.03 ± 0.02 A	0.09
Coleoptera	-	-	0.13 ± 0.03 B	0.55	0.81 ± 0.07 A	2.34
Coleoptera's larvae	-	-	0.17 ± 0.05 A	0.72	0.11 ± 0.05 B	0.32
Diplopoda	-	-	0.01 ± 0.01 A	0.04	-	-
Diplura	-	-	-	-	0.03 ± 0.02 A	0.09
Diptera	5.89 ± 0.89 A	28.05	1.49 ± 0.24 B	6.33	2.29 ± 0.44 B	6.61
Diptera's larvae	0.01 ± 0.01 A	0.05	0.04 ± 0.02 A	0.17	0.04 ± 0.02 A	0.12
Entomobryomorpha	1.09 ± 0.11 B	5.19	7.00 ± 1.28 B	29.75	21.69 ± 2.81 A	62.63
Poduromorpha	0.03 ± 0.03 A	0.14	-	-	-	-
Symphypleona	5.66 ± 2.25 A	26.95	0.27 ± 0.12 B	1.15	0.37 ± 0.15 AB	1.07
Formicidae	3.17 ± 0.47 B	15.10	7.39 ± 1.64 A	31.41	5.03 ± 0.65 AB	14.52
Formicidae's larvae	-	-	0.01 ± 0.01 A	0.04	-	-
Heteroptera	-	-	0,01 ± 0,01 A	0.04	0.01 ± 0.01 A	0,03
Hymenoptera	0.74 ± 0.20 AB	3.52	0.20 ± 0.06 B	0.85	0.90 ± 0.22 A	2.60
Isopoda	0.01 ± 0.01 A	0.05	0.13 ± 0.08 A	0.55	0.01 ± 0.01 A	0.03
Isoptera	0.01 ± 0.01 A	0.05	0.13 ± 0.09 A	0.55	-	-
Lepidoptera's larvae	0.01 ± 0.01 A	0.05	0.04 ± 0.02 A	0.17	0.03 ± 0.02 A	0.09
Mantodea	-	-	0.04 ± 0.04 A	0.17	-	-
Opilionida	-	-	-	-	0.09 ± 0.07 A	0.26
Orthoptera	1.90 ± 0.56 A	9.05	1.80 ± 0.71 A	7.65	0.40 ± 0.12 B	1.16
Pseudoscorpionida	0.01 ± 0.01 A	0.05	-	-	0.01 ± 0.01 A	0.03
Psocoptera	0.04 ± 0.03 A	0.19	0.13 ± 0.05 A	0.55	0.03 ± 0.03 A	0.09
Sternorryncha	0.37 ± 0.13 A	1.76	0.01 ± 0.01 A	0,04	0.04 ± 0.02 A	0.12
Thysanoptera	0.06 ± 0.03A	0.29	-	-	0.10 ± 0.05 A	0.29
Thysanura	-	-	-	-	0.13 ± 0.11 A	0.38
Trichoptera's larvae	-	-	0.03 ± 0.02 A	0.13	-	-
			Dry season (July 2010)			
Acari	0.35 ± 0.11 A	5.86	0.63 ± 0.18 A	3.56	1.02 ± 0.23 A	6.20
Araneae	0.25 ± 0.05 A	4.19	0.25 ± 0.09 A	1.41	0.48 ± 0.07 A	2.92
Auchenorryncha	0.49 ± 0.11 A	8.21	0.48 ± 0.12 A	2.71	0.13 ± 0.04 B	0.79
Coleoptera	0.05 ± 0.02 B	0.84	0.27 ± 0.08 AB	1.53	0.73 ± 0.22 A	4.44
Coleoptera's larvae	0.02 ± 0.02 A	0.34	0.06 ± 0.03 A	0.34	0.06 ± 0.03 A	0.36
Diptera	1.70 ± 0.43 A	28.48	2.08 ± 0.49 A	11.75	1.24 ± 0.28 A	7.54
Diptera's larvae	-	-	0.06 ± 0.03 A	0.34	0.11 ± 0.04 A	0.67
Earthworm's cocoon	-	-	-	-	0.02 ± 0.02 A	0.12
Entomobryomorpha	0.49 ± 0.27 B	8.21	11.44 ± 2.24 A	64.63	10.48 ± 1.26 A	63.75
Poduromorpha	-	-	-	-	0.11 ± 0.08 A	0.67
Symphypleona	0.05 ± 0.02 A	0.84	0.08 ± 0.03 A	0.45	0.21 ± 0.09 A	1.28

Formicidae	2.02 ± 0.47 A	33.84	1.38 ± 0.34 A	7.80	1.00 ± 0.17 A	6.08
Formicidae's larvae	-	-	-	-	0.02 ± 0.02 A	0.12
Heteroptera	0.17 ± 0.07 A	2.85	0.03 ± 0.02 A	0.17	0.08 ± 0.05 A	0.49
Hymenoptera	0.11 ± 0.05 A	1.84	0.16 ± 0.05 A	0.90	0.33 ± 0.09 A	2.01
Isopoda	-	-	0.02 ± 0.02 A	0.11	0.05 ± 0.03 A	0.30
Isoptera	0.02 ± 0.02 A	0.34	0.03 ± 0.02 A	0.17	0.02 ± 0.02 A	0.12
Lepidoptera	0.02 ± 0.02 A	0.34	-	-	-	-
Orthoptera	0.17 ± 0.06 A	2.85	0.16 ± 0.06 A	0.90	0.22 ± 0.09 A	1.34
Pseudoscorpionida	-	-	-	-	0.02 ± 0.02 A	0.12
Psocoptera	0.02 ± 0.02 A	0.34	0.05 ± 0.02 A	0.28	0.03 ± 0.02 A	0.18
Sternorryncha	0.02 ± 0.02 A	0.34	-	-	-	-
Thysanoptera	0.03 ± 0.02 A	0.50	0.51 ± 0.23 A	2.88	0.10 ± 0.04 A	0.61
Thysanura	-	-	-	-	0.02 ± 0.02 A	0.12

[1]Values with significant difference in the same line, are followed by different letters (Kruskal-Wallis Test, p<0.05).

The total abundance and average richness of soil arthropods increased according to the natural trees native regeneration in the understory of the eucalyptus plantations (Table 2). The total richness presented the same pattern in the wet season, while a higher distinction between the plantations and the FOREST was observed in the dry season. The equability index value in the MP was close to that verified in the FOREST and lower than that found in the YP in the wet and in the dry seasons (Table 3).

Table 2. Total average abundance (number of individuals pitfall^{-1} day^{-1} ± standard error) and average richness of taxonomic groups (number of taxonomic groups) of soil arthropods in Young Plantation (YP) and Mature Plantation (MP) of *Corymbia citriodora* (eucalyptus) and Atlantic Rainforest (FOREST) at União Biological Reserve, Brazil[1]

Area	Total Average Abundance		Average Richness	
	Wet Season	Dry Season	Wet Season	Dry Season
YP	21.03 ± 3.05 Ba	5.97 ± 1.01 Bb	11 Aa	8 Bb
MP	23.53 ± 3.27 ABa	17.70 ± 2.23 Aa	12 Aa	10 ABa
FOREST	34.63 ± 3.70 Aa	16.44 ± 1.94 Ab	13 Aa	12 Aa

[1]Values followed by different capital letters in the same column means significant difference among areas at the same season (Kruskal-Wallis Test, p<0.05). Values followed by different minuscule letters in the same line means significant difference between seasons at same area (Mann-Whitney Test, p<0.05).

Table 3. Total richness (total number of taxons) and Pielou's index (equability) of soil arthropods in Young Plantation (YP) and Mature Plantation (MP) of *Corymbia citriodora* (eucalyptus) and Atlantic Rainforest (FOREST) at União Biological Reserve, Brazil

Area	Total Richness		Equability	
	Wet Season	Dry Season	Wet Season	Dry Season
YP	20	17	0,53	0,67
MP	23	17	0,49	0,49
FOREST	24	22	0,44	0,49

Comparing the two climate seasons, the values for total average abundance, average richness, and total richness of soil arthropods were generally higher in the wet season than in the dry season in all three areas studied, while the opposite occurred with the equability value, which was higher in the dry season than in the wet season (Table 3).

The three study areas presented higher Sorensen index values, because all of them was higher than 0.5 (ANDRADE et al., 2002), but this index showed that the arthropods community composition in YP was more similar to MP than to the FOREST, and that the FOREST had higher similarity with MP, than with YP (Table 4).

Table 4. Sorensen index (similarity) of soil arthropods in Young Plantation (YP) and Mature Plantion (MP) of *Corymbia citriodora* (eucalyptus) and Atlantic Rainforest (FOREST) at União Biological Reserve, Brazil

Area	Wet season			Dry season		
	YP	MP	FOREST	YP	MP	FOREST
YP	1	0.76	0.70	1	0.88	0.77
MP	0.76	1	0.77	0.88	1	0.87
FOREST	0.70	0.77	1	0.77	0.87	1

DISCUSSION

The conversion of natural forests by humans into other types of ecosystems results in modifications in the structure and fertility of the soil environment (MOÇO et al., 2003) which are reflected in the soil fauna community (LAVELLE et al., 2006), whose response presents variations depending on which group the organisms belong to (CIVIDANES, 2002; COIMBRA et al., 2007; COPATTI; DAUDT, 2009). This results from the manner in which each group exploits the available resources. Thus, soil arthropods are grouped in three functional categories: predators, saprophages, and ecosystem engineers (LAVELLE, 1996). In the present study, results showed that the establishment of eucalyptus plantations was responsible for the exclusion and/or reduction in abundance of certain groups of soil arthropods, notably those that contain predators and saprophages, as well as favoring other groups, in comparison with native forest.

Therefore, these organisms, which tended to be eliminated from the system, were those most sensitive to environmental impacts (MOÇO et al., 2003), which suggests that, within the soil arthropod community, the predators and saprophages can be considered the most appropriate functional groups for the monitoring of ecosystem functioning and of the impacts caused by the establishment of eucalyptus plantations in the Atlantic forests and probably humid tropical forests. The unfavorable conditions caused to these groups could trigger disruptions in distinct aspects of soil functions (KNOEPP et al., 2000).

The increase in plant community diversity, in terms of species richness and functional groups, may favor the increase in soil arthropod density (EISENHAUER et al., 2011), likely due to the production of more diverse litter in decomposition (LAVELLE et al., 1994; COIMBRA et al., 2007), which can offer the soil improved nutritional conditions in terms of both quality and quantity, such as N, P, and K, compared with more homogenous forest litter (WANG et al., 2008). This effect may be produced by the complementariety of species, when species that occupy different ecological niches coexist in the same environment (LOREAU et al., 2001). It is believed that this process occurred in União Biological Reserve, where the tree community in the MP presented more diversity than the YP (EVARISTO et al., 2011) and thus the plant litter decomposition in the first plantation is more heterogeneous than that of YP (TESCH, 2005). A previous study registered the presence of a litter layer with a higher nutritional quality in the soil surface of the MP (N total = 7.4 g kg^{-1}; C/N ratio = 74) compared with the YP (N total = 4.2 g kg^{-1}; C/N = 114) (VILLELA et al., 2004), which influenced the higher total content of N (3.1 g kg^{-1}) and lower C/N (8.85) in MP soil compared with the YP (N total = 1.3 g kg^{-1}; C/N = 18) (VILLELA et al., 2001).

The total N content in the soil may present a positive correlation to the soil biota composition in eucalyptus forests, as has been verified in Australia (CATTERALL et al., 2001). In addition, as a consequence of a closer canopy in the MP than in the YP, the solar radiation above the soil is probably more intense in the YP, condition that may result in cooler soil temperatures and higher humidity levels in the MP than the YP soil. Thus areas in a more advanced stage of natural regeneration of native tree species can be colonized by a soil arthropod community with higher species richness and/or groups with different survival strategies and a more complex structure than those in a more initial stage (OLIVEIRA et al., 1995; WARREN & ZOU, 2002; LAN et al., 2006; NEGRETE-YANKELEVICH et al., 2006; MAHARNING et al., 2009), due to increased support capacity caused by a higher diversity of niches available in the former (LAVELLE, 1996).

The incidence of solar radiation in the MP may be probably closer to that verified in the FOREST and may therefore also allow the soil temperature and humidity level in the MP to be in line with conditions in the FOREST when compared with the YP. This would justify the increased similarities between the soil arthropod communities in the MP and the FOREST compared to the YP.

Nevertheless, the soil arthropod community in the FOREST presented a higher level of complexity than both eucalyptus plantations. This suggests that, despite the more advanced stage of natural regeneration in the MP in relation to the YP (EVARISTO et al., 2011), the negative impacts on soil arthropods associated with the substitution of the FOREST for the establishment of eucalyptus plantations can still be noticed.

Some species of Opilionida and Pseudoscorpionida are important biological indicators due to their rarity or endemism (MMA, 2003; SOUZA et al., 2008). Opilionida were only observed in a fragment of the Atlantic Forest when compared with a plantation of eucalyptus (*Eucalyptus* sp.) established in a conservation unit located in the Southeast of Brazil (LEWINSOHN et al., 2005), as in the present study. In forests of *Araucaria angustifolia* (Bertoloni) O. Kuntze (Araucariaceae), which are ecosystems associated to the Atlantic Forest biome, the abundance of Araneae and Coleoptera fell sharply with the reduction of the size of fragments, with Pseudoscorpionida pratically disappearing in the smaller fragments, probably due to higher levels of alteration of the vegetation structure and to reduced quantities of litter on the soil surface in these fragments when compared to other larger fragments studied (DUARTE, 2004). Pseudoscorpionida was observed in a preserved FOREST and also in an 18-year-old plantation of *Corymbia citriodora* in the state of Rio de Janeiro (MOÇO et al., 2003). However, this group was not observed in other ecosystems studied: a natural unpreserved forest, a shrubland in regeneration, and a five-year-old pasture.

A reduction of the primary resources of food chains can cause a decline in abundance of predators, those organisms that occupy the top of such chains, which suggests that bottom-up control of ecosystems may be negatively affected by disturbance, as was observed in tropical forests in Mexico subjected to selective logging of native vegetation (NEGRETE-YANKELEVICH et al., 2007). It is believed that this process may explain the loss of predator groups in eucalyptus plantations compared with the native FOREST in the União Biological Reserve. Nevertheless, besides predators, saprophages were also negatively affected by the plantations in the study area and thus may signal a loss of edaphic environment quality as a whole.

Soil arthropod communities in disturbed environments can become increasingly dominated over time by groups of opportunistic organisms that are able to adapt and tolerate the disturbances (LAURANCE et al., 2002). It is possible the case for Orthoptera and Auchenorryncha, as both groups increased their population in the eucalyptus plantations in the present study, in contrast to what happened in the FOREST. The same may be concluded for Diptera, a group composed of adult individuals that don’t exploit forest litter soil resources in this stage of life, and whose average abundance was significantly greater in the YP in the wet season, compared with the other study areas. The importance of Diptera in the YP was highlighted by its elevated relative participation, which was the highest among all groups in the wet season and the second highest in the dry season. Orthoptera is a group capable to colonize simplified environments, replacing other groups. This trait contributes to a higher average abundance of this opportunistic group in newer and disturbed environments (ASSAD, 1997). Within the different taxons of soil arthropods, Orthoptera was the only order whose abundance increased significantly in forest areas of the Brazilian Amazon that were subjected to repeated burnings, compared with others that were not burned, during one year (SILVEIRA et al., 2010).

The elevated total average abundance of soil fauna in the FOREST and MP in relation to the YP, in both climate seasons, was probably influenced by the important contribution of Entomobryomorpha, which ranked in the two most abundant groups in the MP and FOREST in both seasons. In the YP, however, this group occupied the fifth and fourth positions in the wet and in the dry seasons, respectively. One of the reasons for the increase in Entomobryomorpha populations in less disturbed ecosystems is the higher organic material levels in the soil compared with environments subjected to negative impacts (MUSSURY et al., 2002). In addition, when environmental conditions are more stable, a dominance of a small number of groups is observed, groups which become strong competitors for resources (30).

The climate season can influence soil arthropod community because of the rainfall seasonality. Total average abundance, average richness, and total richness of soil arthropods were higher in all three study areas in the wet season, in comparison with the dry season. The higher pluviometry can stimulate the vegetal growth and litter production in wet season, which may increase resources to soil arthropods, in comparison to the dry season (KNOEPP et al., 2000). So, the dry season can prejudice the soil arthropod community.

The results obtained in this study corroborated the hypothesis that exist differences in the composition and structure of soil arthropod communities between two plantations of eucalyptus (*Corymbia citriodora*) in different stages of natural regeneration of Atlantic Forest tree species in the União Biological Reserve.

The soil under the native forest hosted a more complex community of arthropods than the plantations of *Corymbia citriodora*, thus indicating that the replacement of Atlantic Forest by monocultures of this species of eucalyptus can comprise the functioning of the ecosystem.

The climate seasons considerable influenced the soil arthropod communities. In the general, the wet season favoured total average abundance, average richness, and total richness of soil arthropods in all three study areas, in comparison with the dry season.

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RESUMO: A Mata Atlântica é um *hotspot* para a conservação pela elevada biodiversidade e estado atual de degradação. Algumas de suas áreas têm sido substituídas por monoculturas de eucaliptos no Brasil. Os artrópodes do solo podem ser importantes indicadores da recomposição de florestas nativas pós-distúrbio. O presente estudo objetivou testar a hipótese de que existem diferenças na composição e estrutura da comunidade de artrópodes do solo entre dois plantios de eucalipto (*Corymbia citriodora*) em diferentes estágios de regeneração natural de Mata Atlântica (PJ = Plantio Jovem e PM = Plantio Maduro, em estágio de regeneração menos e mais avançado, respectivamente) e um fragmento de Mata Atlântica (FLORESTA), nas estações chuvosa e seca, na Reserva Biológica União, Brasil, usando armadilhas de queda. Archaeognatha, Diplura, Opilionida, e Thysanura restringiram-se à FLORESTA, enquanto Diptera, Isoptera, e Orthoptera foram favorecidos pelas condições microclimáticas nos eucaliptais. A complexidade da comunidade de artrópodes do solo foi maior na FLORESTA do que nos eucaliptais. Em geral, a comunidade de artrópodes do solo apresentou maior abundância total e riqueza de grupos, enquanto a equitabilidade diminuiu, conforme a regeneração da Mata Atlântica avançou nos eucaliptais, formando uma comunidade mais semelhante àquela observada na FLORESTA. A abundância media total, a riqueza média e a riqueza total de artrópodes do solo foram maiores na estação chuvosa em todas as áreas, mas o oposto ocorreu para a equitabilidade. A comunidade de artrópodes do solo se tornou mais complexa com o avanço da regeneração de espécies nativas de Mata Atlântica no sub-bosque dos eucaliptais.

PALAVRAS-CHAVE: *Corymbia citriodora*. Fauna edáfica. Indicadores ecológicos. Regeneração.

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