

FUNCTIONAL COMPOSITION OF TERMITE SPECIES IN AREAS OF ABANDONED PASTURE AND IN SECONDARY SUCCESSION OF THE PARQUE ESTADUAL ALTAMIRO DE MOURA PACHECO, GOIÁS, BRAZIL

COMPOSIÇÃO FUNCIONAL DE CUPINS EM ÁREAS DE PASTAGEM ABANDONADA E EM SUCESSÃO SECUNDÁRIA DO PARQUE ESTADUAL ALTAMIRO DE MOURA PACHECO, GOIÁS, BRASIL

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ABSTRACT: The termites allocate the space and alimentary resources of their habitats with different species or groups of species. As termites are primary consumers, promote the mineralization of nutrients rich in cellulose. The objective of this work was to compare the functional composition of termite species among areas of abandoned pasture and of secondary succession adjacent to the Semideciduous Forest remnants in the Parque Estadual Altamiro de Moura Pacheco, state of Goiás, Brazil. The study area comprised one abandoned pasture, one area in transition from abandoned pasture to forest and one fragment of Semideciduous Forest. The richness of termite species decreased from forest (13) to transition area (9) and to pasture (8). Species that nest and consume humus in the soil were the most common. The termite assemblage of the semideciduous forest remnant presented nesting and trophic habits more diversified than the abandoned pasture and the transition area. Among the 19 species sampled, 12 were recorded in only one area of study. This is the first occurrence of *Incisitermes* sp. in the “Cerrado” biome and was recorded in the transition area. We concluded that when a pasture is no longer used for cattle, begins a process of succession that can restore the community of species of termite.

KEYWORDS: “Cerrado”. Isoptera. Species composition. Semideciduous Forest.

INTRODUCTION

The Cerrado is the second most threatened biome in Brazil (MYERS et al. 2000; KLINK; MACHADO, 2005), mainly due the landscape fragmentation by agricultural expansion (KLINK; MOREIRA, 2002). Currently, only 1.32% of the territory of the state of Goiás are protected in full protection Conservation Units (CUs) (GALINKI, 2003) and 82% of the Cerrado remnants of Goiás are smaller than 1 ha (CUNHA et al., 2007). Thus, the effects of environmental degradation in the “Cerrado” must be estimated for different biological communities.

The structure of biological communities is represented by interactions among species which, starting from the food chain, regulate the energy flux and the recycling of nutrients in the ecosystems. Different assemblages occur in different habitats, latitudes, altitudes and other factors which influence the composition of species. The termites allocate the space and the alimentary resources of their habitats with different species or groups of species (BIGNELL; EGGLETON, 2000). Thus, these authors stated that the fundamental link between the biodiversity of termites and the functioning of the ecosystems is the heterogeneity

of the functional groups, instead of the richness of species.

Termites play important roles as “ecosystem engineers” because of their ability to physically modifying the environment through the construction of nests, movement and physical and chemical alteration of the soil (LAVELLE et al., 1997; LAWTON, 1997). They are considered key species because of their role in the processes of decomposition and carbon mineralization and as primary consumers (BIGNELL; EGGLETON, 2000; BLACK; OKWAKOL, 1997).

The aim of the present study was to compare the functional composition of termite species in areas of abandoned pasture and in secondary succession adjacent to the remnants of Semideciduous Forest in the Parque Estadual Altamiro de Moura Pacheco (PEAMP).

MATERIAL AND METHODS

Study site

The PEAMP is one of the largest protected areas of Goiás, where research activities were interrupted for the construction of a dam. The construction of the João Leite dam will flood about 30% of the area of the PEAMP (SANEAGO, 2009).

The PEAMP is a full protection conservation unit, created to promote the protection the last remnants of Seasonal Forest or Mesophytic Forest in the state of Goiás (Inventário Faunístico, 2007; Inventário da Flora, 2008). The area of the PEAMP is approximately 3746 hectares (ha) between the coordinates 16°30' and 16°34' S and 49°07' and 49°11' W and stretches over four municipalities, whose altitude is about 800 m. In 2002, the construction of the Ribeirão João Leite dam began, bordering the PEAMP. The dam service is the expansion public water supply for the state capital of Goiás and adjacent municipalities, according to the water master plan for Goiânia (SANEAGO, 2009).

According to the Floristic Inventory of PEAMP (2008), the Semideciduous Forest is the dominant vegetation (77% of PEAMP), besides the presence of Gallery Forests at the banks of Ribeirão João Leite and small patches of Cerrado (3% of PEAMP). There are also old pastures (20% of PEAMP), remnants of the agropastoral activities developed in the region. The internal area of the park is not used for agriculture anymore and since 1992, the pastures are in recovery process of secondary succession.

Three vegetation types were selected for the study: abandoned pastures, transition zones from abandoned pasture to forest and Mesophytic Forest. The abandoned pastures possess exotic grasses – *Brachiaria decubens* Stapf. and *Melinis minutifolia* Beauv. – that can reach a height of up to 1.5 m and that are gradually being substituted by native shrubby and arboreal species. In the transition area, the exotic grass is present in a lower quantity than in the pasture and there is a higher presence of the shrub-arboreal layer, such as the pioneer species *Trema micrantha* (L.) Blume and *Solanum lycocarpum* St. Hil. The Mesophytic Forest is characterized by the presence of arboreal species with a height of more than 10 m and canopy.

Data collection

The termite sampling was done regularly between 9:00 and 16:00 from February until April 2008, because the possibility of collecting termites in different microhabitats is higher in the rainy season. The total area sampled was 240 m² and the total sampling time was 30 hours. In each vegetation type (Pasture, Transition and Forest), two transects were marked, divided into four quadrats of 5 x 2 m, at a distance of 30 m from one another and from the area's border (CUNHA et al., 2006). A total of 24 quadrats were sampled, divided into eight quadrats for each area. Each quadrat was examined over a

period of 1 hour per collector searching for termites in microhabitats: holes in the soil (at depths up to 20 cm), under stones, nests, leaf litter, deadwood, tree trunks, roots, trail trees. The samples were identified to species or morphospecies using dichotomy keys (CONSTANTINO, 2000, 2002), notes and revisions (CANCELLO, 1989; CONSTANTINO, 1995; CONSTANTINO et al. 2006; KRISHNA; ARAUJO, 1968; MATHEWS, 1977; ROCHA; CANCELLO, 2007). The samples are stored in the Laboratório de Pesquisa Ecológica e Educação Científica of the Universidade Estadual de Goiás.

Data analysis

The frequency of occurrence of termite species in the quadrats was tabulated in the presence-absence matrix. Species accumulation curves were plotted for each area from termite species richness (Mao Tau) and their respective confidence intervals (\pm 95%), estimated by EstimateS (COLWELL, 2005).

The functional groups of the termite community were analysed according to the composition of the trophic groups and the nest site. The species was classified in four feeding guilds according to Lima and Costa-Leonardo (2007): a) xylophagous are wood feeders species; b) humivorous feed on humus and organic matter on soil; c) harvester forage on surface and feed on litter and/or grass; d) intermediate feed of organic matter in high decomposed state. The nest site was determined by field observation and by comparison with Constantino (1998): a) wood: lives in deadwood or in decaying wood; b) nest: builds its own nest or lives in the nest of others termite species; c) soil: lives in the soil diffuse galleries. The association between the functional group (feeding guild and nesting) of the termite richness and the three vegetation types was tested using Chi-Square with six degrees of freedom.

RESULTS

In the three areas, 63 termite samples were collected separated into 17 genus of three families: one specie of the Kalotermitidae, two species of the Rhinotermitidae and 16 species of the Termitidae (Table 1). In one quadrat of pasture, no termites were found.

The richness of termite species decreased from forest (13 species) to recovery areas: nine in transition zones and eight in the abandoned pastures (Figure 1). Twelve species were registered exclusively in one of the three areas of the PEAMP: two in the pasture, two in the transition area and

eight in the forest (Table 1). This was the first occurrence of *Incisitermes* sp. in the “Cerrado”

biome, according to Constantino (1998; 2002).

Table 1. Frequency of termite species of the three vegetation types of the PEAMP, feeder group and nesting.

Taxon	Pasture	Transition	Forest	Feeder group	Nesting
Kalotermitidae					
<i>Incisitermes</i> sp.		1		Xylophagous	Wood
Rhinotermitidae/ Heterotermitinae					
<i>Heterotermes sulcatus</i> Mathews, 1977			2	Xylophagous	Wood
<i>Heterotermes tenuis</i> (Hagen, 1858)			1	Xylophagous	Wood
Termitidae / Apicotermitinae					
<i>Anoplotermes</i> sp.	5	4	8	Humivorous	Soil
<i>Aparatermes</i> sp.	1	4	3	Humivorous	Soil
<i>Grigiotermes</i> sp.	1	5		Humivorous	Nest
<i>Ruptitermes</i> sp.	3	3	1	Harvester	Soil
<i>Tetimatermes</i> sp.	1			Humivorous	Soil
Termitidae/ Nasutitermitinae					
<i>Diversitermes diversimiles</i> (Silvestri, 1901)			1	Harvester	Nest
<i>Nasutitermes corniger</i> (Motschulsky, 1855)			2	Xylophagous	Nest
<i>Velocitermes velox</i> (Holmgren, 1906)			1	Harvester	Nest
Termitidae/ Syntermitinae					
<i>Cornitermes snyderi</i> Emerson, 1952	1	2	1	Harvester	Nest
<i>Labiotermes laticephalus</i> (Silvestri, 1901)		1		Humivorous	Nest
<i>Syntermes molestus</i> (Burmeister, 1839)			2	Harvester	Nest
Termitidae/ Termitinae					
<i>Cylindrotermes caata</i> (Rocha & Canello, 2007)		1	1	Intermediate	Wood
<i>Dentispicotermes globicephalus</i> (Silvestri, 1901)			1	Intermediate	Soil
<i>Neocapritermes opacus</i> (Hagen, 1858)	1	3		Intermediate	Soil
<i>Neocapritermes talpa</i> (Holmgren, 1906)	1			Intermediate	Soil
<i>Orthognathotermes</i> sp.			1	Humivorous	Soil

The functional composition of termite groups does not differ statistically among the three areas of the PEAMP for the feeding guilds ($\chi^2=5.38$; $P=0.5$) neither for nesting ($\chi^2=3.49$; $P=0.5$). But, in the transition areas and in the abandoned

pastures, humivorous species and that nest in soil were more common, while in the forest most species feed on litter. The species which live in the soil and in nests occur in the three vegetation types, but no epigeal nest was sampled in the quadrats.

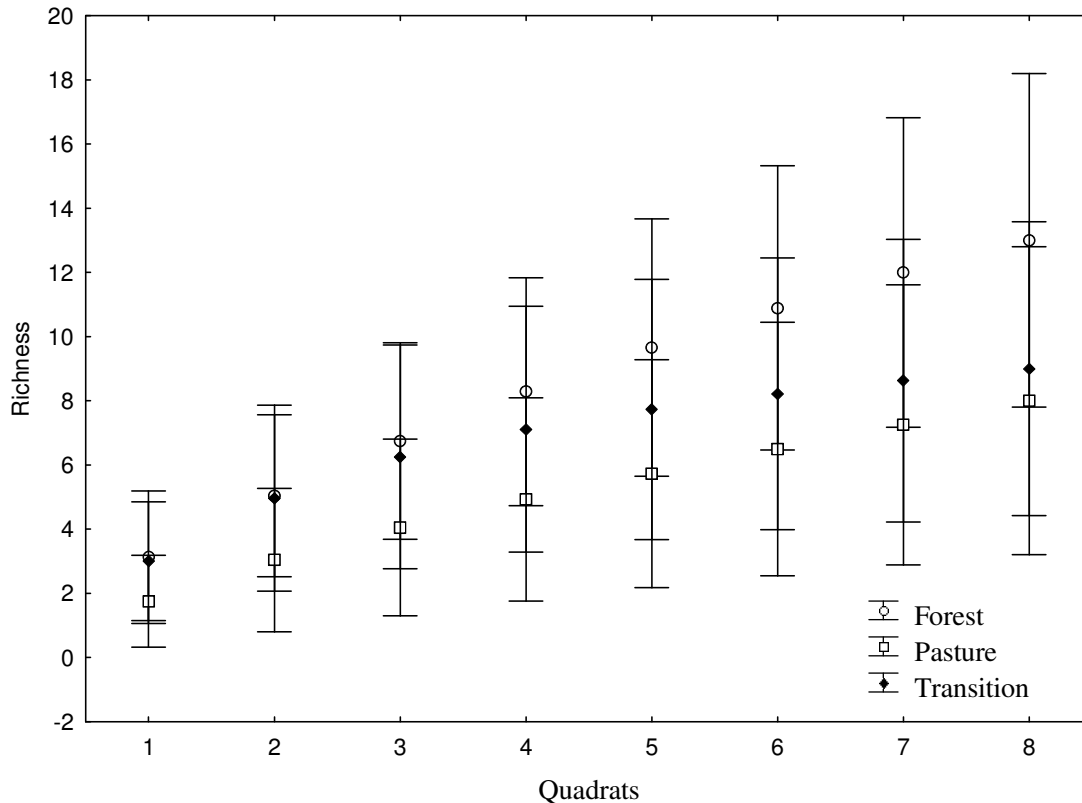


Figure 1. Species accumulation curve of termite richness in three vegetation areas of the PEAMP, Goiás, Brazil. Points: Mao Tau richness; Transverse lines: \pm 95% confidence interval.

DISCUSSION

Almost 20 years have already passed since the creation of the PEAMP, a period during which the pastures and the transition zones did not suffer any type of anthropogenic disturbance. The forests of the PEAMP showed a higher richness of termite species and of trophic groups than settings in a human-modified landscape (transition zones and abandoned pastures). Other studies done in Brazil also confirmed that the simplification of the environment for the implementation of pastures (BRANDÃO; SOUZA, 1998; CARRIJO et al., 2008) or selective logging (VASCONCELLOS et al., 2008) or fragmentation (FLORENCIO; DIEHL, 2006) are associated to the decrease of the termite richness.

Despite the termite assemblages of the abandoned pastures and transition zones did not differ significantly from the Semideciduous Forest remnant, some species occur only in one of three areas sampled. The most common species groups – *Anoplotermes* sp. in the forest and the pasture and *Grigiotermes* sp. in the transition zone – are those which nest in the soil and feed on humus, being essential agents in the nutrient cycle and for the

recovery of the soil community. This dominance pattern of humivorous species living in the soil as discussed elsewhere (ACKERMAN et al., 2009; BANDEIRA; VASCONCELLOS, 2002; CARRIJO et al., 2008; CUNHA et al., 2006). An experimental study about disturbance in tropical forests in Cameroon showed that the diversity of termites recovered faster in the sites where there was dead wood, whose communities were composed by humivorous and xylophagous species (DAVIES et al., 1999).

This study revealed that when a pasture is no longer used for cattle, begins a process of succession that can restore the community of species of termite. Therefore, we suggest that the park receives intense environmental monitoring in order to evaluate the secondary succession process initiated in the areas of abandoned pasture and in the transition zones.

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RESUMO: Os cupins subdividem o espaço e os recursos alimentares de seus habitats entre diferentes espécies ou grupos de espécies. Como são consumidores primários, promovem a mineralização de nutrientes ricos em celulose. O objetivo deste trabalho foi comparar a composição de espécies de cupins entre áreas de pastagem abandonada e em sucessão secundária adjacentes aos remanescentes de Floresta Estacional Semidecidual no Parque Estadual Altamiro de Moura Pacheco, Goiás. A área de estudo compreendeu uma pastagem abandonada, uma área de transição pastagem-floresta e um fragmento de Floresta Estacional Semidecidual. A riqueza de espécies de cupins decresceu da Mata (13) para a Transição (9) e para a Pastagem (8). Espécies humívoras e que nidificam no solo foram as mais comuns. A assembléia de cupins da mata semidecidual remanescente apresentou nidificação e hábitos alimentares mais diversos do que as da pastagem abandonada e da área de transição. Das 19 espécies amostradas, 12 foram registradas em somente uma das áreas de estudo. A ocorrência de *Incisitermes* sp. é inédita no bioma Cerrado e foi registrada na área de transição. Concluímos que quando uma pastagem deixa de ser usada para a criação de gado bovino, inicia-se um processo de sucessão que pode recuperar a comunidade de espécies de cupins.

PALAVRAS-CHAVE: Cerrado. Composição de espécies. Floresta Estacional Semidecidual. Isoptera.

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